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7 Steps to Specifying a DL205 System

7 steps to help specify a successful system

Before you begin selecting products for your DL205 PLC system, be sure to evaluate all of your application needs and any future growth potential.

Step 1 Review the DL205 family of products

The DL205 family offers a wide variety of products. Please review the product offering starting on page 4–23.

Step 2 Select a CPU, programming tool and cable

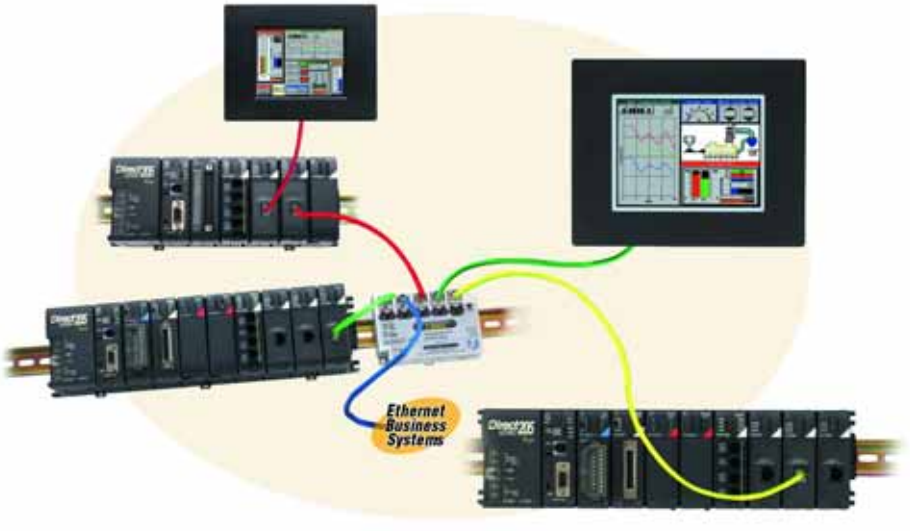
The DL205 family offers four CPUs: the D2-260, D2-250-1, D2-240 and D2-230. The WinPLC, a Windows® CE-based CPU, is also covered in this step. Please take the time to understand the features and specifications of each CPU model (i.e. built-in communications ports protocols, instructions, etc.).

To program the DL205 CPUs, choose between the Windows-based *Direct*SOFT32 programming software and PC cable or handheld programmer. The WinPLC requires Think & Do Studio or Think & Do Live! for programming. CPU-slot slave base controllers are also introduced in this step.

Step 3 Additional communications ports needed?

If your application requires more than the built-in CPU communications ports, then select the H2-ECOM Ethernet Communications Module or the D2-DCM Serial Communications Module. These modules add more ports for networking or connection to an HMI, etc. The H2-SERIO serial communications module can be used with the WinPLC to add more communications ports.

The following 7 steps will help you specify a DL205 PLC system. They are also covered in more detail on the pages that follow. Your first priority when designing a system should be safety. Please make sure that all of the components in your system will operate within the product's environmental and operating specifications. This desk reference is intended to provide abbreviated product descriptions, benefits and prices. It is not intended to be a substitute for the product manuals.



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7 Steps to Specifying a DL205 System

Step 4 Select the discrete, analog and specialty I/O modules

Since there are several different types of I/O and speciality modules available for the DL205 system, it is important to review the module specifications in detail when selecting them for your system. The hardware specifications for the modules are described at the end of this DL205 section, starting with the speciality modules and followed by the discrete and analog I/O modules.

Step 5 Choose an I/O configuration method

The DL205 offers several configurations of I/O. Choose among local I/O, local expansion I/O and remote I/O. A DL205 system can be developed using a combination of the configuration arrangements. It is important to understand the octal addressing scheme and I/O module placement restrictions that are described in this step.

Step 6 Check the power budget

It is very important to verify that the selected CPU and I/O modules will operate within the base power budget. Tables list the power supplied and consumed by each DL205 device. This step also describes base dimensions and mounting requirements.

Step 7 Place your order!

Place your order either online at www.automationdirect.com, by calling 1-800-633-0405 or by faxing your order to 1-770-889-7876. See the Ordering section in this desk reference for details.

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Step 1: Review the DL205 Product Family

CPUs

D2-260 – 30.4K words total memory
2 communications ports
16 built-in PID loops with auto-tuning
D2-250-1 – (Replaces D2-250)
14.8K words total memory
2 communications ports
4 built-in PID loops with auto-tuning
D2-240 – 3.8K total memory,
2 communications ports
D2-230 – 2.4K total memory
1 communications port
Windows CE CPUs
WinPLC (H2-WPLC*-**)

Programming tools

DirectSOFT32 Programming Software for Windows (PC-PGMSW or PC-PGM-205)
Handheld Programmer (D2-HPP)

Bases

3-slot base (includes power supply)
110/220 VAC (D2-03B-1)
12/24 VDC (D2-03BDC1-1)
4-slot base (includes power supply)
110/220 VAC (D2-04B-1)
12/24 VDC (D2-04BDC1-1)
6-slot base (includes power supply)
110/220 VAC (D2-06B-1)
12/24 VDC (D2-06BDC1-1)
125 VDC (D2-06BDC2-1)
9-slot base (includes power supply)
110/220 VAC (D2-09B-1)
12/24 VDC (D2-09BDC1-1)
125 VDC (D2-09BDC2-1)

Local expansion modules

(D2-250-1 or D2-260 using D2-0*B-1 or D2-0*BDC*-1 only)
Base expansion module (D2-EM)
Expansion base controller module (D2-CM)
Expansion base cable (D2-EXCBL-1)

Discrete input modules

DC input
8-pt. 12-24 VDC sink/source (D2-08ND3)
16-pt. 24 VDC sink/source (D2-16ND3)
32-pt. 24VDC sink/source (D2-32ND3)
32-pt. 5-12VDC sink/source (D2-32ND3-2)

Discrete input modules (continued)
AC input
8-pt. 110 VAC (D2-08NA-1)
16-pt. 110 VAC (D2-16NA)
8-pt. 220 VAC (D2-08NA-2)

Discrete output modules

DC output
4-pt. 12-24 VDC sink (D2-04TD1)
8-pt. 12-24 VDC sink (D2-08TD1)
8-pt. 12-24 VDC source (D2-08TD2)
16-pt. 12-24 VDC sink (D2-16TD1-2)
16-pt. 12-24 VDC source (D2-16TD2-2)
32-pt. 12-24 VDC sink (D2-32TD1)
32-pt. 12-24 VDC source (D2-32TD2)
AC output
8-pt. 18-220 VAC (D2-08TA)
8-pt. 20-125 VAC (F2-08TA)
12-pt. 18-110 VAC (D2-12TA)
Relay output
4-pt. 4A/pt (Isolated) (D2-04TRS)
8-pt. 1A/pt (D2-08TR)
8-pt. 10A/pt. (F2-08TR)
8-pt. 7A/pt (Isolated) (F2-08TRS)
12-pt. 1.5A/pt (D2-12TR)

Combination discrete modules

4-pt. 24 VDC in/4pt Relay Out (D2-08CDR)

Analog modules

Analog input
4-ch. in, 12 bit, current (F2-04AD-1)
4-ch. in, 12 bit, voltage (F2-04AD-2)
8-ch. in, 12 bit, current (F2-08AD-1)
8-ch. in, 12 bit, voltage (F2-08AD-2)
Analog output
2-ch. out, 12 bit, current (F2-02DA-1)
2-ch. out, 16 bit, current (Isolated) (F2-02DAS-1)
2-ch. out, 12 bit, voltage (F2-02DA-2)
2 -ch. out, 16 bit, voltage (Isolated) (F2-02DAS-2)
8-ch. out, 12 bit, current (F2-08DA-1)
8-ch. out, 12 bit, voltage (F2-08DA-2)
Combination analog in/out
4-ch. in/2-ch. out, 12 bit, current (F2-4AD2DA)
8-ch. in/4-ch. out, 16 bit, current (F2-8AD4DA-1)
8-ch. in/4-ch. out, 16 bit, voltage (F2-8AD4DA-2)
Temperature input
4-ch. in, RTD (F2-04RTD)
4-ch. in, Thermocouple (F2-04THM)

Communications/ networking modules

Ethernet Communications Module
(H2-ECOM (-F)
(H2-ECOM 100)
Data Communications Module
(D2-DCM)

Remote I/O modules

Ethernet
Ethernet Remote Master Module (H2-ERM(-F))
Ethernet Base Controller (slave)
(H2-EBC(-F))
(H2-EBC 100)
Serial
Remote Master Module (D2-RMSM)
Remote Slave Module (D2-RSSS)

Specialty modules

Basic CoProcessor (F2-CP128)
8-pt Input Simulator (F2-08SIM)
Counter I/O (H2-CTRIO)
Counter Interface (D2-CTRINT)

CPU-slot slave controllers

Ethernet Base Controller (H2-EBC)
DeviceNet Slave (F2-DEVNETS-1)
Profibus Slave (H2-PBC)
SDS Slave (F2-SDS-1)

Operator interface

See the Operator Interface section in this desk reference for a complete line of compatible text and touch panels and configuration software.

Connection systems

See the Connection Systems section in this desk reference for information on ***DIN***nector terminal blocks, ***ZIP***Link connection systems and other connection accessories for use with the DL205 system.

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STEP 2: SELECT THE CPU, PROGRAMMER AND CABLE

There are many things to consider when choosing a CPU, most of which depend on your particular application. The facing page provides a comparison between the CPUs. This section provides a quick summary of the key features for each CPU.

System capacity

System capacity is the ability of the CPU to accommodate a variety of applications. Consider both ladder memory and data registers (V-memory). For ladder memory, most Bodean instructions require one word. Some other instructions, such as timers, counters, etc. require two or more words.

Our V-memory locations are 16-bit words and are useful for data storage, etc.

If you think you may exceed 256 local I/O points, then select the D2-250-1 or the D2-260 CPU which support local expansion of up to two or four additional bases, respectively.

The D2-240, D2-250-1 and D2-260 support the Ethernet and standard Remote Master module that are used to build a remote I/O network. Port 2 on the D2-250-1 and D2-260 can also serve as a remote I/O master.

Performance

If you are using basic Bodean instructions and speed is not the primary concern, then the D2-230 or D2-240 will do the job. For applications that require fast scan times, additional communications or advanced instructions, choose the D2-250-1 or D2-260 CPU. The D2-260 is our fastest CPU for performing even the most basic of math or data instructions, and will provide better overall performance than the other DL205 CPUs.

Programming and diagnostics

Our CPUs offer an incredible array of instructions and diagnostic features that can save you many hours of programming and debug time. From basic Bodean contact logic to PID and floating point math, we have it covered! The table on the next page covers some of the basic instruction categories, but for more details, see our complete list of instructions at the end of this section. If you already have *Direct*SOFT32 and/or a Handheld Programmer, you may have to upgrade the software/firmware to accommodate the D2-260.

Built-in CPU communications

Every DL205 CPU provides at least one built-in RS232 communication port. If you're using an operator interface, then you should choose the D2-240, D2-250-1 or D2-260 CPU. The D2-240, D2-250-1 and D2-260 CPUs offer two built-in communication ports. The D2-240 supports our *Direct*NET™ slave protocol on the bottom port, which provides a quick and easy network connection to any *Direct*NET master. If you need the most flexibility possible, then consider the D2-250-1 or D2-260 CPU. These CPUs offer built-in *Direct*NET slave support capability on the top and bottom ports, and *Direct*Net/MODBUS RTU master/slave support on the bottom. The bottom port supports baud rates up to 38.4K baud. The D2-260 provides support for ASCII IN/OUT communications.

If you require more than two ports, we also offer an Ethernet Communications Module that can be used to quickly add a communication port to a DL205 system with a D2-240, D2-250-1 or D2-260 CPU. The D2-DCM module can also be added to these CPUs to provide an additional serial communications port.

The WinPLC brings PLC and PC technologies together by providing a Windows CE operating system environment for the DL205 hardware. See the WinPLC pages later in this section for details on the WinPLC.

H2-WPLC*-**

D2-260

D2-250-1

D2-240

D2-230

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DL205 CPU Specifications

DL205 CPU Comparison				
System Capacity	**D2-230**	**D2-240**	**D2-250-1**	**D2-260**
Total memory available (words)	2.4K	3.8K	14.8K	30.4
Ladder memory (words)	2048 EEPROM	2560 EEPROM	7680 Flash	15872 Flash
V-memory (words)	256	1024	7168	14592
Battery backup	Yes	Yes	Yes	Yes
Total CPU memory I/O pts. available ***(actual I/O pts. depend on I/O configuration method selected)***	256	896 (320 X + 320 Y + 256 CR)	2048 *(512 X + 512 Y + 1024 CR)*	8192 *(1024 X + 1024 Y + 2048 CR + 2048 GX + 2048 GY)*
Local I/O (pts.)	256	256	256	256
Local Expansion I/O (pts.)	none	none	768 (2 exp. bases max) (*Including local I/O*)	1280 (4 exp. bases max.) (*Including local I/O*)
Serial Remote I/O (pts.)	N/A	896 max. (*Including local I/O*)	2048 max. (*Including local and exp.I/O*)	8192 max. (*Including local & exp. I/O*)
Remote I/O channels	N/A	2	8 (7+1 CPU port)	8 (7+1 CPU port)
I/O per remote channel	N/A	2048 *(limited to 896)*	2048	2048
Ethernet Remote I/O	N/A	Yes	Yes	Yes
Discrete I/O pts.	N/A	896 max. (*Including local I/O*)	2048 max. (*Including local and exp.I/O*)	8192 (*Including local and exp.I/O*)
Analog I/O channels	N/A	Map into V-memory	Map into V-memory	Map into V-memory
Remote I/O channels	N/A	Limited by power budget	Limited by power budget	Limited by power budget
I/O per remote channel	N/A	16,384 *(limited to 896)*	16,384 (16 fully expanded H4-EBC slaves using V-memory and bit-of-word instructions)	16,384 (16 fully expanded H4-EBC slaves using V-memory and bit-of-word instructions)
Performance				
Contact execution (Bodean)	3.3µs	1.4µs	0.61µs	0.61µs
Typical scan (1K Bodean)	4-6ms	10-12ms	1.9ms	1.9ms
Programming and Diagnostics				
RLL Ladder Style	Yes	Yes	Yes	Yes
RLL^{PLUS}/Flowchart Style (Stages)	Yes/256	Yes/512	Yes/1024	Yes/1024
Run time editing	Yes	Yes	Yes	Yes
Variable/fixed scan	Variable	Variable	Variable	Variable
Instructions	113	129	174	231
Control relays	256	256	1024	2048
Timers	64	128	256	256
Counters	64	128	128	256
Immediate I/O	Yes	Yes	Yes	Yes
Subroutines	No	Yes	Yes	Yes
For/Next loops	No	Yes	Yes	Yes
Timed Interrupt	No	Yes	Yes	Yes
Integer Math	Yes	Yes	Yes	Yes
Floating-point Math	No	No	Yes	Yes
Trigonometric functions	No	No	No	Yes
Table Instructions	No	No	No	Yes
PID	No	No	Yes, 4 loops	Yes, 16 loops
Drum Sequencers	No	No	Yes	Yes
Bit of Word	No	No	Yes	Yes
ASCII Print	No	No	Yes	Yes
Real-time clock/calender	No	Yes	Yes	Yes
Internal diagnostics	Yes	Yes	Yes	Yes
Password security	Yes	Multi-level	Multi-level	Multi-level
System and user error log	No	No	Yes	Yes
Communications				
Built-in ports	Port 1 RS-232C	Port 1 RS-232C and Port 2 RS-232C	Port 1 RS-232C and Port 2 RS (232C/422)	Port 1 RS-232C and Port 2 RS (232C/422/485)
K-sequence (proprietary protocol)	Yes	Yes	Yes	Yes
*Direct*NET™	No	Yes	Yes	Yes
MODBUS RTU master/slave	No	No	Yes	Yes
ASCII communications	No	No	OUT	IN/OUT
Maximum baud rate	9600	19.2K port 2	38.4K port 2	38.4K port 2

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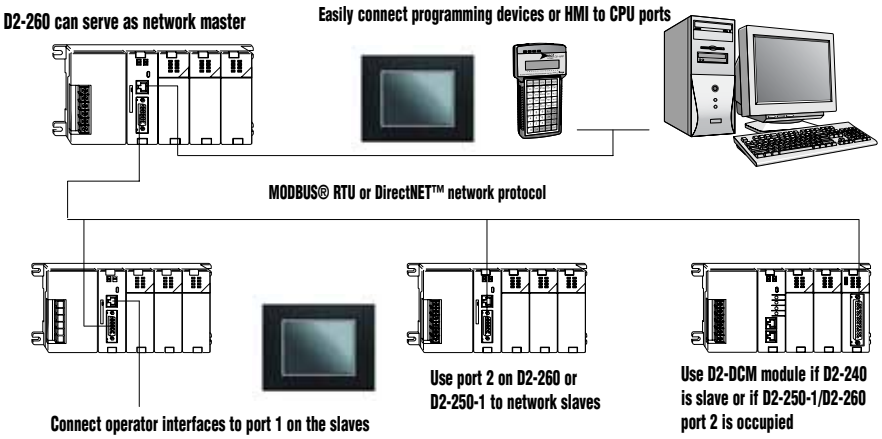
D2-260 KEY FEATURES


D2-260 can serve as network master
Easily connect programming devices or HMI to CPU ports
MODBUS® RTU or DirectNET™ network protocol
Use port 2 on D2-260 or D2-250-1 to network slaves
Use D2-DCM module if D2-240 is slave or if D2-250-1/D2-260 port 2 is occupied
Connect operator interfaces to port 1 on the slaves

D2-260: Our most powerful DL205 CPU

Our D2-260 CPU provides all the capabilities of the other DL205 CPUs (as well as our D4-450 CPU), plus several additional features rarely found in a PLC of this size. With such an incredible array of features, you may be able to replace PLCs costing hundreds (or thousands) more.

Release 4.0 or higher of *Direct*SOFT32™ is required to program the D2-260. If you're using a handheld programmer, version 2.10 of the handheld programmer firmware is required. Here are a few key features about the D2-260 CPU:

Local expansion I/O

The D2-260 supports local expansion up to five total bases (one CPU base and four expansion bases). Expansion bases are commonly used when there are not enough slots available in the CPU base, when the base power budget will be exceeded, or when placing an I/O base at a location away from the CPU base (but within the expansion cable limits). All local and expansion I/O points are updated on every CPU scan. Each local expansion base requires the D2-CM module in the CPU slot. The local CPU base requires the D2-EM Expansion Module, as well as each expansion base. For more information on local expansion, refer to the Expansion Modules pages later in this section.

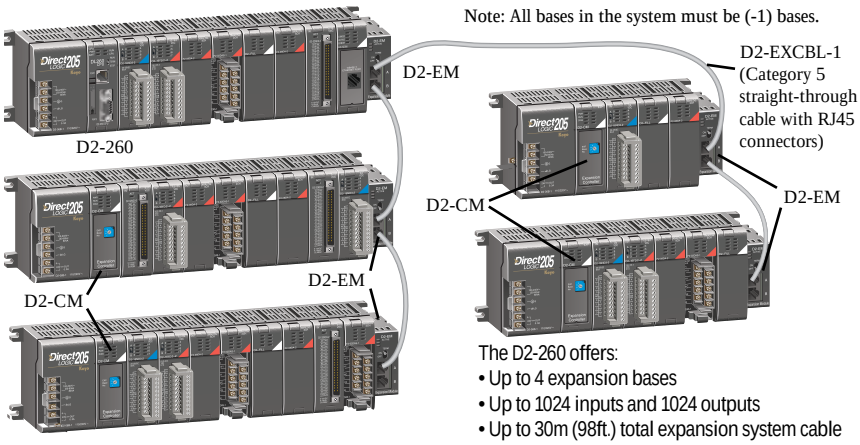
Powerful built-in CPU communications

The D2-260 offers two communications ports that provide a vast array of communication possibilities. The top RJ-12 RS-232C port can be used for programming, connection to an EZText/EZTouch or DV-1000 operator interface panel, or as a single K-sequence or *Direct*NET slave. The 15-pin bottom port (port 2) supports RS232C or RS422/RS485. This port offers several different protocol options such as:

- K-sequence
- ***Direct***NET Master/Slave
- MODBUS RTU Master/Slave
- ASCII In/Out Communications

Port 2 can also serve as a remote I/O master. The D2-260 supports the Ethernet Communication module and Data Communication Module for additional communications ports.

D2-260 local expansion system



Note: All bases in the system must be (-1) bases.

The D2-260 offers:
- Up to 4 expansion bases
- Up to 1024 inputs and 1024 outputs
- Up to 30m (98ft.) total expansion system cable

16 PID loops with auto-tuning

The D2-260 CPU can process up to 16 PID loops directly in the CPU. You can select from various control modes including automatic, manual, and cascade. There are also a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The loop operation parameters (Process Variable, Setpoint, Setpoint Limits, etc.) are stored in V-memory, which allows easy access from operator interfaces or HMIs. Setup is accomplished with easy-to-use setup menus and monitoring views in *Direct*SOFT32 programming.

The auto-tuning feature is easy to use and can reduce setup and maintenance time. Basically, the CPU uses the auto-tuning feature to automatically determine near optimum loop settings. See the D2-250-1 CPU section for a PID loop control block diagram.

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D2-260 Key Features

Full array of instructions

The right instruction can greatly simplify your programming task and can save hours of programming time.

The D2-260 supports over 225 powerful instructions, such as:

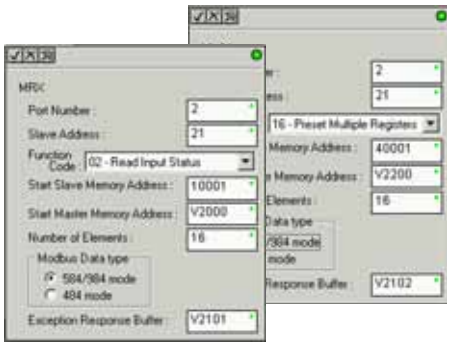
- Four types of drum sequencers
- Leading / trailing edge triggered one-shots
- Bit of word manipulation
- Floating point conversions
- Trigonometric functions
- Table instructions
- ASCII IN/OUT instructions

For a complete list of instructions supported by all DL205 CPUs, see the end of this section.

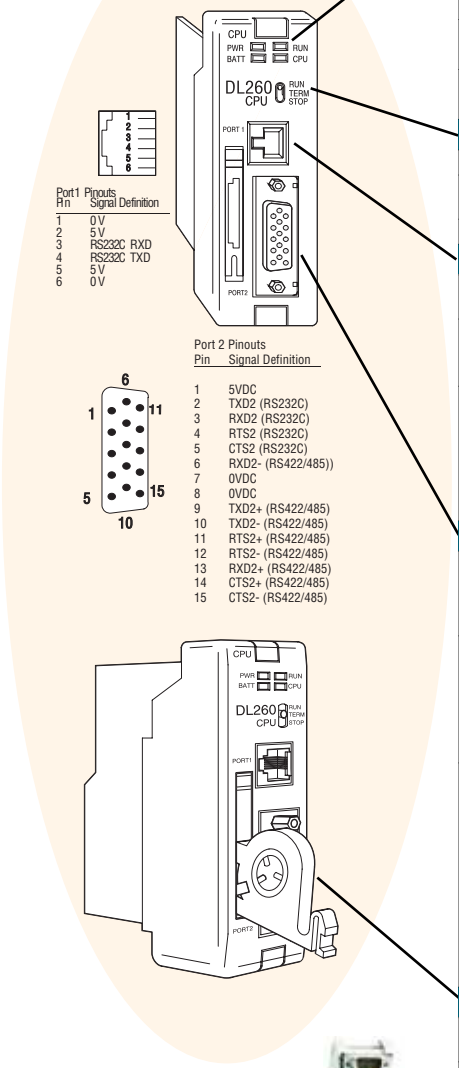
New MODBUS RTU instructions

The D2-260 CPU supports new easy-to-use MODBUS Read/Write instructions that expand our existing MODBUS network instruction capabilities. The MRX or MWX instructions allow you to enter native Modbus addressing in your ladder program with no need to perform octal-to-decimal conversion. We added Function codes 05, 06 and the ability to read Slave Exception Codes. These flexible instructions allow the user to select the following parameters within one instruction window:

- 584/984 or 484 MODBUS data type
- Slave node (0-247)
- Function code
- MODBUS starting master / slave memory address
- Number of bits
- Exception code starting address



Examples of MRS and MWX instructions in *Direct*SOFT 4.0



CPU Status Indicators		
RUN	ON	CPU is in RUN mode
	OFF	CPU is in PROGRAM mode
BATT	ON	Battery backup voltage is low
	OFF	Battery backup voltage is OK or disabled
CPU	ON	CPU internal diagnostics detects error
	OFF	CPU is OK
PWR	ON	CPU power good
	OFF	CPU power failure
Mode Switch		
RUN		Puts CPU into RUN mode
TERM		Allows peripherals (HPP, *Direct*SOFT32) to select the mode of operation
STOP		Forces CPU out of RUN mode
Port 1		
Protocols		K-sequence slave, *Direct*NET™ slave, MODBUS RTU slave
Devices		Can connect w/HPP, *Direct*SOFT32, EZText/EZTouch, DV-1000, O/I panels, or any *Direct*NET master
Specs.		6P6C phone jack connector RS232C 9,600 baud Fixed address Odd parity only 8 data bits one start, one stop asynchronous, half-duplex, DTE
Port 2		
Protocols		K-sequence slave, *Direct*NET Master/Slave, MODBUS RTU Master/Slave, ASCII IN/OUT, Remote I/O Master
Devices		Can connect w/many devices, such as PCs running *Direct*SOFT32, DSData, HMI packages, EZText/EZTouch panels, DV-1000, other O/I panels, any *Direct*NET or MODBUS RTU master or slave, or ASCII devices
Specs.		HD15 connector RS232C/RS422/485* 300/600/1200/2400/4800 9600/19.2K/38.4K baud Odd, even, or no parity Selectable address (1-90, HEX 1 – 5A) 8 data bits, one start, one stop Asynchronous, Half-duplex, DTE
Battery (Optional)		
D2-BAT-1		Coin type, 3.0V Lithium battery, 560mA, battery number CR2354

Note: Batteries are not needed for program backup. However, you should order a battery if you have parameters in V-memory that must be maintained in case of a power outage.
**RS485 for MODBUS protocol only*

DN-15TB

*ZIP*Link communications adapter modules

*ZIP*Link cables and communications adapter modules offer fast and convenient screw terminal connections for the D2-260 bottom port. They are RS232/422 DIP switch selectable. See the Connection Systems section in this desk reference for part numbers and descriptions.

On-board memory

The D2-260 has 15.5K words of flash memory on board for your program plus 14.2K words of data registers. With flash memory, you don't have to worry about losing the program due to a bad battery.

Built-in remote I/O connection

The bottom port on the D2-260 can be used as a master for serial remote I/O networks (see the D2-RSSS later in this section for details).

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D2-260 KEY FEATURES

ASCII communications instructions

The D2-260 CPU supports several easy-to-use instructions that allow ASCII strings to be read into and written from the PLC communications ports.

Raw ASCII: Port 2 can be used for either reading or writing raw ASCII strings, but not for both.

Embedded ASCII characters: The D2-260 can decipher ASCII embedded within a supported protocol (K-Sequence, DirectNet, Modbus, Ethernet) via the CPU ports, H2-ECOM or D2-DCM.

Here's how the D2-260 can receive ASCII input strings:

1. ASCII IN (AIN) - This instruction configures port 2 for raw ASCII input strings with parameters such as fixed and variable length ASCII strings, termination characters, byte swapping options, and instruction control bits. Use barcode scanners, weight scales, etc. to write raw ASCII input strings into port 2 based on the (AIN) instruction's parameters.
2. Write embedded ASCII strings directly to V-memory from an external HMI or similar master device via a supported communications protocol using the CPU ports, H2-ECOM or D2-DCM. The AIN instruction is not used in this case.
3. If a D2-260 PLC is a master on a network, the Network Read instruction (RX) can be used to read embedded ASCII data from a slave device via a supported communications protocol using port 2, H2-ECOM or D2-DCM. The RX instruction places the data directly into V-memory.

Here's how the D2-260 can write ASCII output strings:

1. Print from V-memory (PRINTV) - Use this instruction to write raw ASCII strings out of port 2 to a display panel or a serial printer, etc. The instruction features the starting V-memory address, string length, byte swapping options, etc. When the instruction's permissive bit is enabled, the string is written to port 2.
2. Print to V-memory (VPRINT) - Use this instruction to create pre-coded ASCII strings in the PLC (i.e. alarm messages). When the instruction's permissive bit is enabled, the message is loaded into a pre-defined V-memory address location. Then the (PRINTV) instruction may be used to write the pre-coded ASCII string out of port 2. American, European and Asian Time/Date stamps are supported.
3. Print Message (PRINT) - This existing instruction can be used to create pre-coded ASCII strings in the PLC. When the instruction's permissive bit is enabled, the string is written to port 2. The VPRINT/PRINTV instruction combination is more powerful and flexible than the PRINT instruction.
4. If a D2-260 PLC is a master on a network, the Network Write instruction (WX) can be used to write embedded ASCII data to an HMI or slave device directly from V-memory via a supported communications protocol using port 2, H2-ECOM or D2-DCM.

Additional new instructions that help manage the ASCII strings

The following instructions can be very helpful in managing the ASCII strings within the CPU's V-memory:

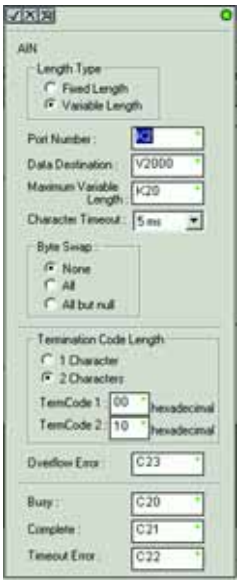
ASCII Find (AFIND) - Finds where a specific portion of the ASCII string is located in continuous V-memory addresses. Forward and reverse searches are supported.

ASCII Extract (AEX) - Extracts a specific portion (usually some data value) from the ASCII find location or other known ASCII data location.

Compare V-memory (CMPV) - This instruction is used to compare two blocks of V-memory addresses and is usually used to detect a change in an ASCII string. Compared data types must be of the same format (i.e. BCD, ASCII, etc.).

Swap Bytes (SWAPB) - Usually used to swap V-memory bytes on ASCII data that was written directly to V-memory from an external HMI or similar master device via a communications protocol. The AIN and AEX instructions have a built-in byte swap feature.

Examples of AIN and VPRINT instructions in *Direct*SOFT 4.0



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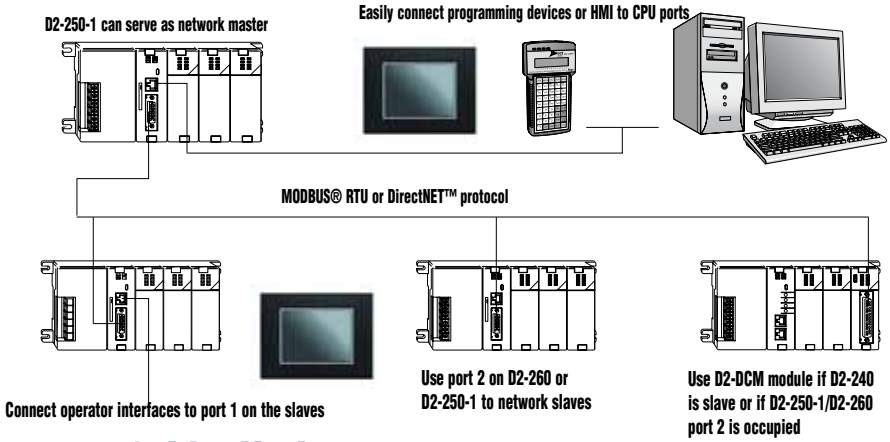
D2-250-1 Key Features


D2-250-1 can serve as network master
Easily connect programming devices or HMI to CPU ports
MODBUS® RTU or DirectNET™ protocol
Connect operator interfaces to port 1 on the slaves
Use port 2 on D2-260 or D2-250-1 to network slaves
Use D2-DCM module if D2-240 is slave or if D2-250-1/D2-260 port 2 is occupied

D2-250-1 replaces D2-250

Our D2-250-1 CPU replaces the D2-250 CPU. The D2-250-1 offers all the features and functionality of the D2-250 with the addition of local I/O expansion capability. The D2-250-1 offers an incredible array of features for a CPU that costs so little.

Release 2.1 or higher of *Direct*SOFT™ is required to program the D2-250-1. Release 4.0 is required if you intend to use local expansion I/O. If you're using a handheld programmer, version 2.10 of the handheld programmer firmware is required. A few key features of the D2-250-1 CPU follow.

Local expansion I/O

The D2-250-1 supports local expansion up to three total bases (one CPU base and two expansion bases). Expansion bases are commonly used when there are not enough slots available in the CPU base, when the base power budget will be exceeded or when placing an I/O base at a location away from the CPU base, but within the expansion cable limits. All local and expansion I/O points are updated on every CPU scan. Each local expansion base requires the D2-CM module in the CPU slot. The local CPU base requires the D2-EM Expansion Module, as well as each expansion base. For more information on local expansion, refer to the Expansion Modules pages later in this section.

Powerful built-in CPU communications

The D2-250-1 offers two communication ports that provide a vast array of communication possibilities. The top RS232C port is for programming, connection to an EZText/EZTouch operator interface panel or DV-1000, or to serve as a single DirectNET slave. The 15-pin bottom port (port 2) supports RS232C or RS422. This port offers several different protocol options such as:

- K-sequence
- ***Direct***NET master/slave
- MODBUS RTU master/slave

Port 2 can also serve as a remote I/O master. The D2-250 supports the Ethernet Communication Module and Data Communication Module for additional communications ports.

Four PID loops with auto-tuning

The D2-250-1 CPU can process up to 4 PID loops directly in the CPU. You can select from various control modes including automatic, manual, and cascade control. There are a wide variety of alarms including Process Variable, Rate of Change, and Deviation. The loop operation parameters (Process Variable, Setpoint, Setpoint Limits, etc.) are stored in V-memory, which allows easy access from operator interfaces or HMIs. Setup is accomplished with easy-to-use setup menus and monitoring views in *Direct*SOFT32 programming.

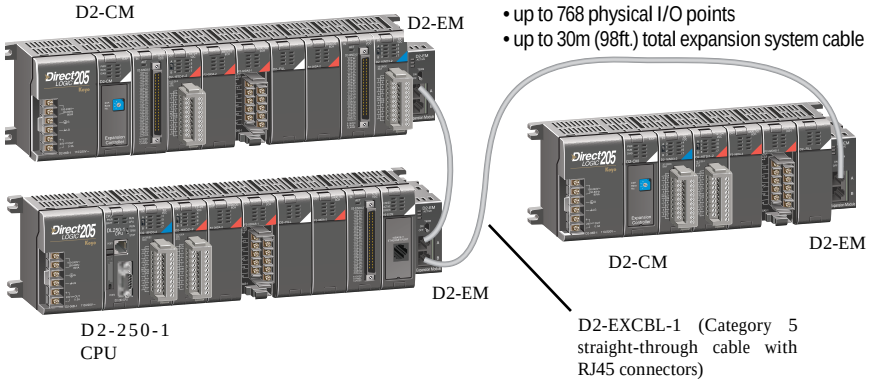
The auto-tuning feature is easy to use and can reduce setup and maintenance time. Basically, the CPU uses the auto-tuning feature to automatically determine near optimum loop settings. See the next page for a PID loop control block diagram.

D2-250-1 local expansion system

Note: All bases in the system must be (-1) bases.

The D2-250-1 offers:

- up to 2 expansion bases
- up to 768 physical I/O points
- up to 30m (98ft.) total expansion system cable



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D2-250-1 KEY FEATURES

Full array of instructions

The D2-250-1 supports over 160 powerful instructions, such as:

- Four types of drum sequencers
- Leading and trailing edge triggered one-shots
- Bit of word manipulation
- Floating point conversions
- 4 PID loops

For a complete list of instructions supported by all DL205 CPUs, see the end of this section.

On-board memory

The D2-250-1 has 7.6K words of flash memory on board for your program plus 7.1K words of V-memory (data registers). With flash memory, you don't have to worry about losing the program due to a bad battery. If you have critical data stored in the capacitor backed V-memory, simply purchase the optional lithium battery (D2-BAT-1) to permanently maintain these parameters.

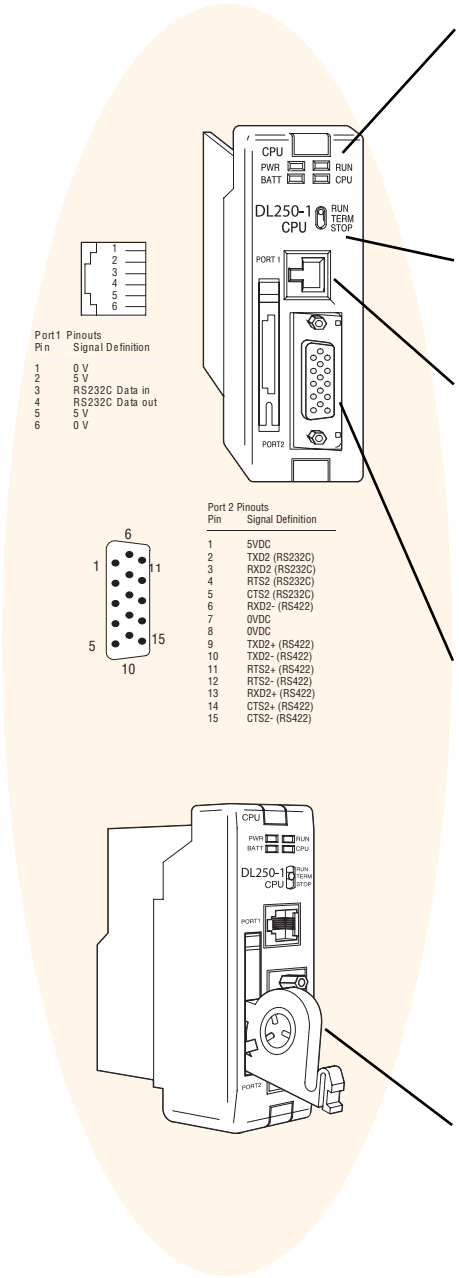
Built-in remote I/O connection

In addition to providing outstanding communications capabilities, the bottom port on the D2-250-1 can also be a master for remote I/O networks. If you need extra I/O at a remote distance from the CPU, you can use this port to add up to seven of our remote slave stations. (See the D2-RSSS for additional information. later in this section).

DN-15TB

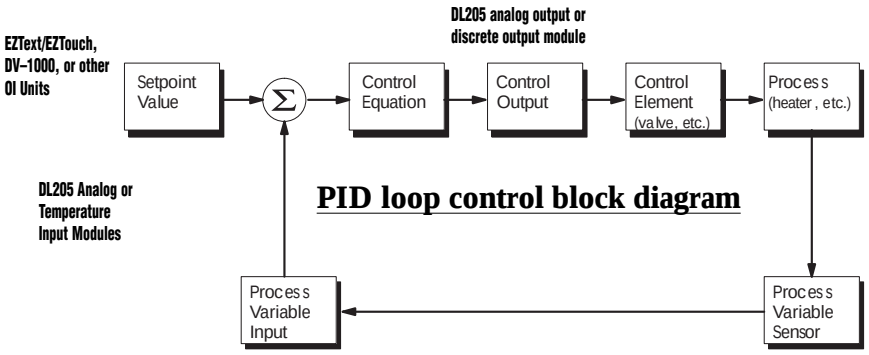
*ZIP*Link communications adapter modules

*ZIP*Link cables and communications adapter modules offer fast and convenient screw terminal connections for the D2-250-1 lower port. They are RS232/422 DIP switch selectable. For part numbers and descriptions, see the Connection Systems section in this desk reference .



CPU Status Indicators		
RUN	ON	CPU is in RUN mode
	OFF	CPU is in PROGRAM mode
BATT	ON	Battery backup voltage is low
	OFF	Battery backup voltage is OK or disabled
CPU	ON	CPU internal diagnostics detects error
	OFF	CPU is OK
PWR	ON	CPU power good
	OFF	CPU power failure
Mode Switch		
RUN		Puts CPU into RUN mode
TERM		Allows peripherals (HPP, *Direct*SOFT32) to select the mode of operation
STOP		Forces CPU out of RUN mode
Port 1		
Protocols		K-sequence slave, *Direct*NET™ slave, MODBUS RTU slave
Devices		Can connect w/HPP, *Direct*SOFT32, EZText/EZTouch, DV-1000, O/I panels, or any *Direct*NET master
Specs.		6P6C phone jack connector RS232C 9,600 baud Fixed address Odd parity only 8 data bits one start, one stop asynchronous, half-duplex, DTE
Port 2		
Protocols		K-sequence slave, *Direct*NET Master/Slave, MODBUS RTU Master/Slave, ASCII OUT, Remote I/O Master
Devices		Can connect w/many devices, such as PCs running *Direct*SOFT32, DSData, HMI packages, EZText/EZTouch panels, DV-1000, other O/I panels, any *Direct*NET or MODBUS RTU master or slave, or ASCII devices
Specs.		HD15 connector RS232C/RS422 300/600/1200/2400/4800 9600/19.2K/38.4K baud Odd, even, or no parity Selectable address (1-90, HEX 1 – 5A) 8 data bits, one start, one stop Asynchronous, Half-duplex, DTE
Battery (Optional)		
D2-BAT-1		Coin type, 3.0V Lithium battery, 560mA, battery number CR2354

Note: Batteries are not needed for program back-up. However, you should order a battery if you have parameters in V-memory that must be maintained in case of a power outage.



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D2-230/240 Key Features

DL240 CPU
D2-240 <--->

D2-240: our best value DL205 CPU

The D2-240 provides a subset of the D2-250-1's capabilities. If you need a good CPU with multiple communications ports, and complex math or PID isn't required, then the D2-240 is the CPU for you!

Built-in memory

There is 2.5K of EEPROM program memory in the D2-240. No additional memory is required.

If you have critical data stored in the capacitor backed V-memory, simply purchase the optional lithium battery (D2-BAT) to permanently maintain these parameters as well.

Powerful instructions

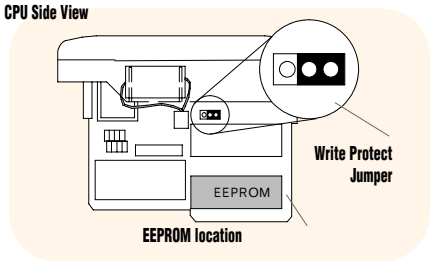
The D2-240 instructions cover most of the capability of our more powerful D2-250-1 and allow you to cover a wide variety of applications. Instructions include Bodean logic, data manipulation, integer math, interrupts, subroutines, FOR/NEXT loops, etc. For a complete list of instructions, see the back of this section.

Two built-in RS232C communications ports

The D2-240 offers two communication ports. The top port can be used for a direct connection to a personal computer for programming, to our handheld programmer, EZTouch/EZText panels, or to the DV-1000. The bottom port is a slave-only port and supports our *Direct*NET™ or K-sequence protocol at speeds up to 19.2K baud. If you're using an operator interface or if you plan on connecting the system to a network later on, then you can choose the D2-240. The D2-240 also supports the D2-DCM Data Communication Module and the H2-ECOM Ethernet Communication Modules.

DL205 spare EEPROM chips

There may be cases where you want to have a spare EEPROM chip available. For example, maybe you need to upgrade a customer's machine with your latest enhancements. You can purchase extra EEPROM chips (two per pack). These can be installed in the CPU (D2-230/D2-240 only) and programmed, or they can be programmed directly with the DL205 handheld programmer.



	D2-EE-1	D2-EE-2
CPU	D2-230	D2-240
CPU Program Storage Capacity	2.0K	2.4K
Writing Cycle Life	10,000	10,000
Write Inhibit	CPU jumper	CPU jumper
Memory Clear Method	Electrical	Electrical

DL230 CPU
D2-230 <--->

D2-230: our lowest price DL205 CPU

The D2-230 is our most economical CPU in the DL205 product family. If you are looking at the DL205 primarily because of the size or for other reasons that don't require lots of CPU horsepower, then give the D2-230 a try.

Built-in EEPROM memory

There is 2.0K of EEPROM program memory in the D2-230. No additional memory is required.

If you have critical data stored in the capacitor backed V-memory, simply purchase the optional lithium battery (D2-BAT) to permanently maintain these parameters as well.

One built-in communications port

The D2-230 has only one communication port. If you are considering any network connections in the future, you will need the D2-240, D2-250-1 or D2-260 CPU. The extra port may be worth the cost, especially during machine startup or troubleshooting sessions. The D2-230 does not support the Ethernet or Data Communications modules.

Basic instruction set

The D2-230 provides a subset of the D2-240's well-rounded instructions. The D2-230's instructions cover basic Bodean and simple integer math.

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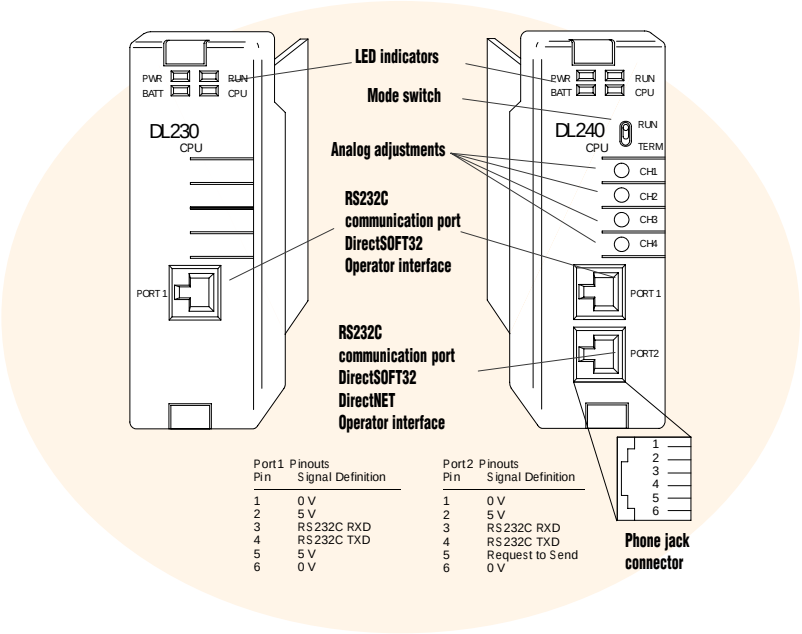
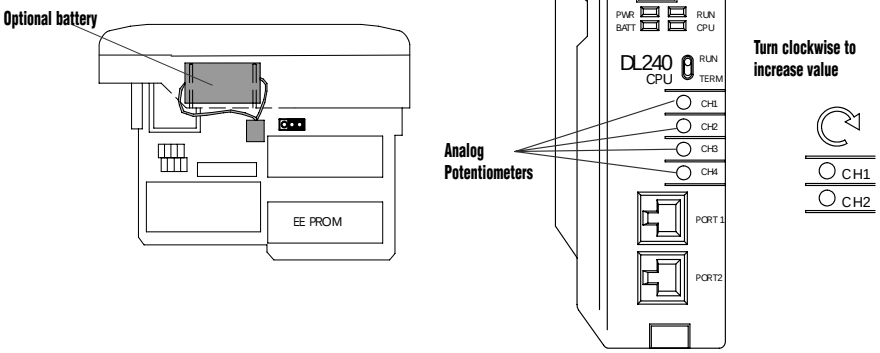
D2-230/240 KEY FEATURES

The diagram to the right shows the various hardware features found on the D2-230 and D2-240 CPUs.

CPU Status Indicators		
RUN	ON	CPU is in RUN mode
	OFF	CPU is in PROGRAM mode
BATT	ON	Battery backup voltage is low
	OFF	Battery backup voltage is OK or disabled
CPU	ON	CPU internal diagnostics detects error
	OFF	CPU is OK
PWR	ON	CPU power good
	OFF	CPU power failure
Mode Switch (D2-240 only)		
RUN		Puts CPU into RUN mode
TERM		Allows peripherals (HPP, *Direct*SOFT32) to select the mode of operation
Port 1		
Protocols		K-sequence slave
Devices		Can connect w/HPP, *Direct*SOFT32™, EZText/EZTouch, DV-1000
Specs.		6P6C phone jack connector RS232C 9,600 baud Fixed address Odd parity only 8 data bits, one start, one stop asynchronous, half-duplex, DTE
Port 2 (D2-240 only)		
Protocols		K-sequence slave, *Direct*NET slave
Devices		Can connect w/many devices, such as PCs running *Direct*SOFT32, DSData, HMI packages, EZText/EZTouch panels, DV-1000, or any *Direct*NET master
Specs.		6P6C phone jack connector 300/600/1200/2400/4800 9600/19.2K baud Odd or no parity Selectable address (1-90, HEX 1 – 5A) 8 data bits, one start, one stop Asynchronous, Half-duplex, DTE
Battery (Optional)		
D2-BAT		CR14250SE
Note: Batteries are not needed for program back-up. However, you should order a battery if you have parameters in V-memory that must be maintained in case of a power outage.		



CPU side view



Four external potentiometers for adjustments

There are four potentiometers on the face plate of the D2-240 CPU. They have a resolution of 256 steps and can be used to externally adjust four predefined V-memory locations inside the D2-240 CPU. You specify upper and lower limits for the values and the CPU takes care of the rest!

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DL205 Programming Tools and Cables

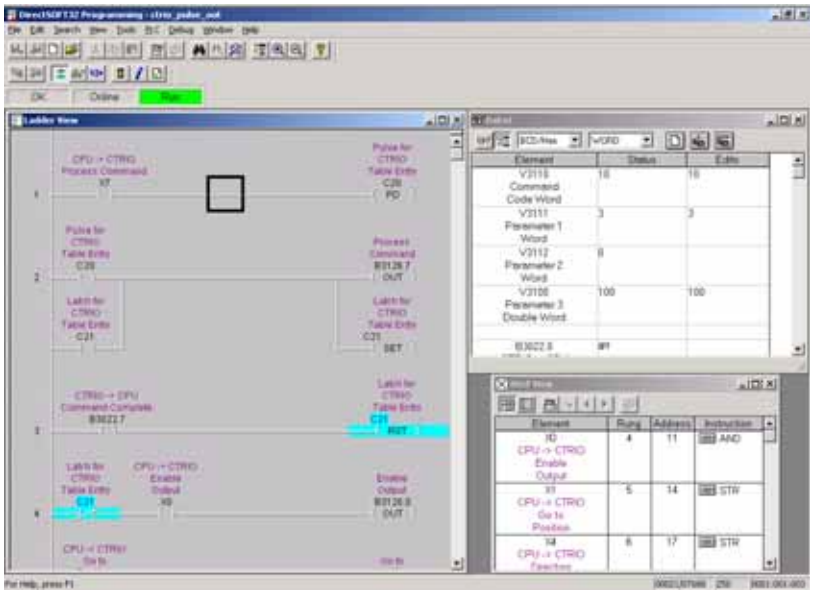
Selecting a programming device

There are two tools for programming the DL205 CPUs: *Direct*SOFT32 PC-based programming software and the D2-HPP handheld programmer.

*Direct*SOFT32 programming software

Our powerful Windows-based programming packages make it easy for you to program and monitor your DL205 PLC system. The two versions of the software that support the DL205 CPUs are described in the table below. See the Software section in this desk reference for detailed information on *Direct*SOFT32.

DirectSoft32 Part Number	Description
PC-PGM-205	Programs only the DL205 CPUs D2-230/240/250-1/260
PC-PGMSW	Programs all PLC families DL05/06/105/205/305/405
Note: The D2-260 requires *Direct*SOFT32 version 4.0 or later	

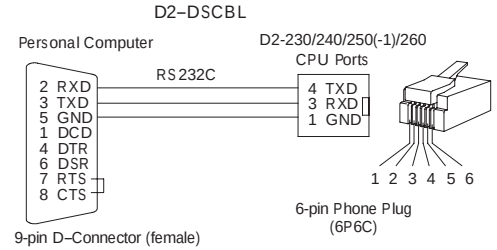


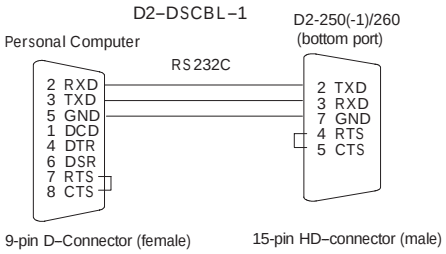
DL205 programming cables

Choose the proper cable to connect the DL205 CPU to your PC running *Direct*SOFT32.

CPU	Port	Cable
D2-230	Only one	D2-DSCBL
D2-240	Top port	D2-DSCBL
	Bottom port	D2-DSCBL
D2-250-1	Top port	D2-DSCBL
	Bottom port	D2-DSCBL-1
D2-260	Top port	D2-DSCBL
	Bottom port	D2-DSCBL-1

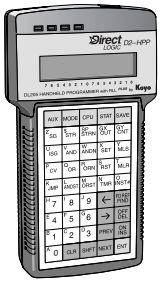
Pin labeling conforms to IBM DTE and DCE standards





Handheld programmer

The D2-HPP handheld programmer connects to an RJ12 phone jack port on any of the DL205 CPUs. The handheld unit contains a zero force insertion socket that can be used to store programs on an optional EEPROM. Can be used with DL05, DL06, DL105, DL205, and D3-350 models.



D2-HPP Handheld programmer cable included (DV-1000CBL)

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DL205 WinPLC: Windows® CE-based CPU

DL205 WinPLC
H2-WPLC1-EN <--->
H2-WPLC2-EN <--->
H2-WPLC3-EN <--->
PC-WPLC-START*
PC-WPLC-LIVE*

Specifications	H2-WPLC1-EN	H2-WPLC2-EN	H2-WPLC3-EN
Processor	Hitachi SH3 Series 7708 Processor		
Processor Speed	40 MHz	100 MHz	100 MHz
Pre-loaded Software	Runtime engine compatible with Think & Do Studio or Think & Do Live		
Memory	4MB FLASH EE ROM, 2MB RAM, 64kB battery-backed RAM10Mbps		8MB FLASH EE ROM, 8MB RAM, 64kB battery-backed RAM10Mbps
Indicators	Power, Link/Act, Run, Error		
Local I/O Points	256 (224 if using H2-ERM in module slot for Ethernet remote I/O)		
Ethernet Remote I/O pts.	256 (using H2-ERM master in local WinPLC base and H*-EBC or T1H-EBC remote slave		
Port 0	RJ12, 6-pin modular, serial port, supports K-sequence, or any protocol from Windows CE		
Port 1	RJ45, 8-pin modular, Ethernet 10MBPS		
I/O Interface	Backplane to DL205 (Up to 9-Slot base), expandable with H2-ERM		
Power Consumption	680 mA at 5VDC		
Weight	6 oz.		
Operating Temperature	0–60°C		
Storage Temperature	-20-70°C		
Agency Listings	UL Listing		
Manufacturer	Host Automation Products, LLC.		

PC control with a WinPLC

The WinPLC provides a Windows® CE operating system environment in our DL205 CPU hardware. The small size and low cost of DL205 products is desirable, but the operating systems of the D2-230, 240, 250-1 and 260 CPUs are proprietary (like most PLCs). The WinPLC provides a hybrid PC PLC solution that brings the best of the PLC and PC control worlds together. A WinPLC system is the best solution if your applications requires:

- Complex math
- Heavy serial communications (can use the H2-SERIO module)
- Advanced data manipulation
- Advanced handling of string or array data
- Up to 64 PID loops

Here's how it works

The WinPLC module is plugged into the CPU slot of the DL205 base. It uses Windows® CE, a real-time operating system combined with the advantages of open standard software such as OPC, ActiveX and other Microsoft communications tools. The WinPLC offers both deterministic control and open communications. It uses advanced software development tools for control, data management, communication and integration with business systems. The WinPLC supports the following DL205 modules only:

- All discrete and analog modules
- Temperature input modules
- H2-SERIO serial communications module
- H2-ERM module for Ethernet remote I/O (limited to one ERM and one EBC slave per system)
- H2-CTRIO Counter I/O module

DL205 specialty modules not listed above are not supported by the WinPLC.

Built-in Ethernet port

The WinPLC is programmed via a built-in 10MB Ethernet port. WinPLCs can use OPC or DDE to link to an HMI or other application using this high-speed port. Or, share tags with any controller running Think & Do software for coordinated control with a PC system. The built-in Ethernet port can also be used for peer-to-peer communications between multiple WinPLCs.

Built-in serial port

A built-in RS-232C serial port lets you connect an EZTouch, EZText or other operator interfaces to the WinPLC. You can also connect to devices such as barcode readers, weight scales or serial modems to the serial port. Unlike most RLL programming, the Think & Do programming method is designed for easy communication programming and string manipulation. Up to nine additional serial ports can be added to a WinPLC system by using the H2-SERIO serial communication module. For more information on the H2-SERIO module see "Additional Serial Ports for the WinPLC" later in this section.

Programming the WinPLC

Creating flowcharts (projects) for the WinPLC, requires one of the following development packages running on a PC equipped with an Ethernet card: Think & Do Live! (PC-ENT-LIVE), the low-cost T&D Live! for WinPLC programming pack (PC-WPLC-LIVE), or Think & Do Studio (PC-ENT-SDD). Since each WinPLC includes its own run-time license, you can program as many WinPLCs as you need, at no additional cost. When you compile your project, the PC automatically downloads the flowcharts into the WinPLC. Then at runtime (or at power-up), the WinPLC will run the flowchart program.

CE-only version WinPLC

This version of the WinPLC is not preconfigured with any control software. It's for qualified OEMs or software developers who want to develop their control code in VB or C++. AUTOMATIONDIRECT does not sell this version of the WinPLC. If you are interested in the CE-only version, visit www.hosteng.com for details.

See the Think & Do PC Control software section in this desk reference for information on the PC-WPLC-START Starter Kit, and the PC-WPLC-LIVE Think & Do Live! WinPLC programming package.

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DL205 CPU-Slot Slave Controllers

Overview

There are currently four slave "base controllers" or "slave I/O controllers" available for the DL205 hardware. This allows you to use industry proven DL205 I/O for general purpose distributed applications.

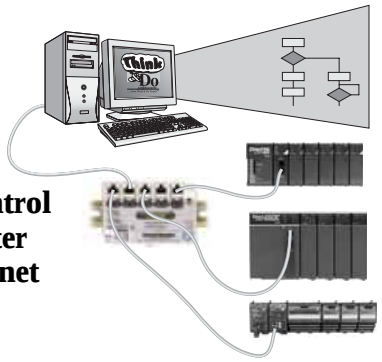
The controller modules are plugged into the CPU slot of any size DL205 base. The slave controllers must be connected to a network master controller module or to a PC running PC-based control, HMI or SCADA software.

H2-EBC

Ethernet Base Controller Module

See page 4–52

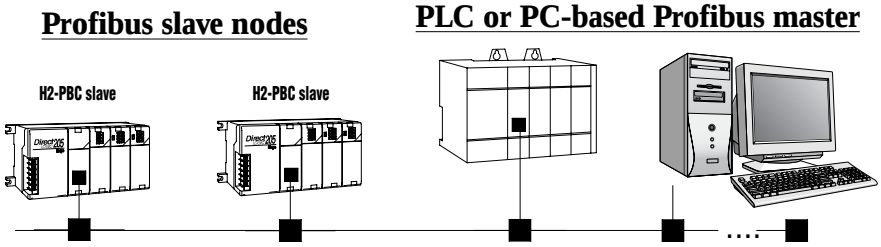
PC-based control software master or PLC Ethernet remote I/O



H2-PBC

Profibus DP Slave Base Controller Module

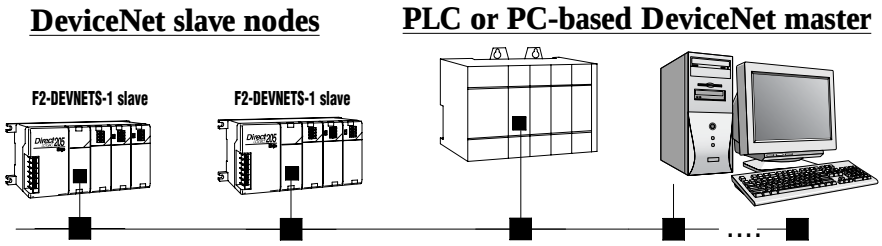
See page 4–60



F2-DEVNETS-1

DeviceNet Slave Module

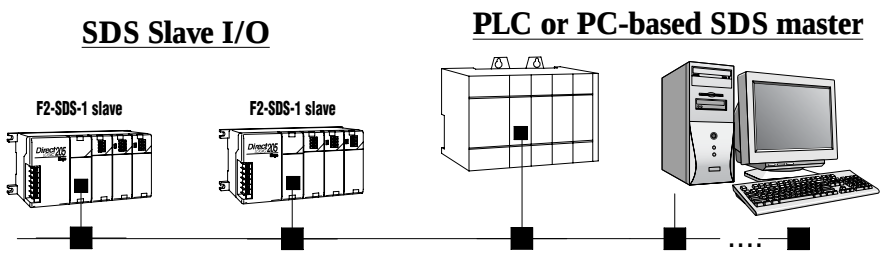
See page 4–62



F2-SDS-1

Smart Distributed System I/O

See page 4–64



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STEP 3: ADDITIONAL COMMUNICATIONS PORTS NEEDED?

Do you need communications ports in addition to the built-in CPU communications ports to connect to an operator interface or HMI? Would you like to connect to a network of other AUTOMATIONDIRECT products, or a MODBUS RTU or Ethernet network? If so, then choose between the H2-ECOM Ethernet communications module or the D2-DCM serial data communications module. Both modules' specifications and communications details are covered later in this section.

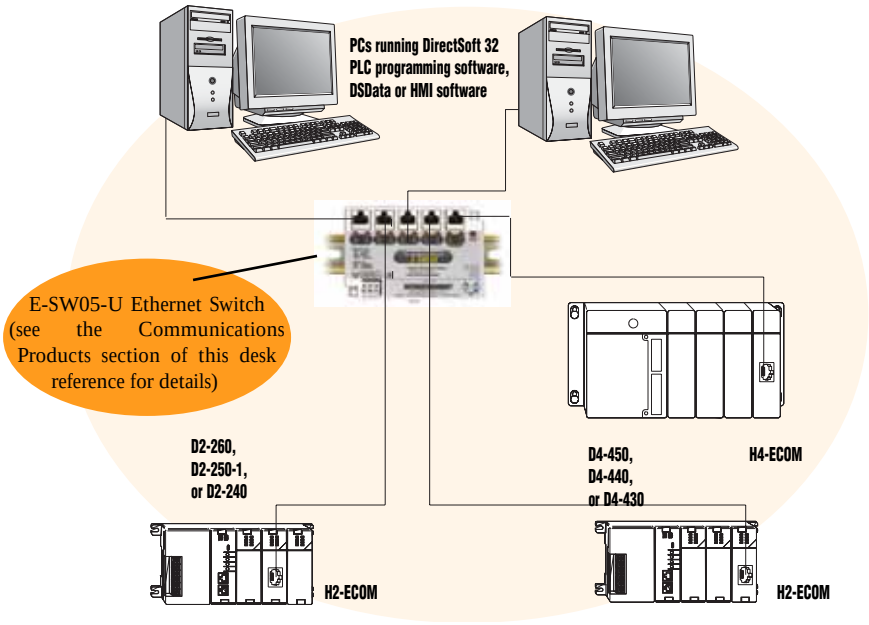
Ethernet networking with the H2-ECOM

The D2-260, D2-250-1 and D2-240 CPUs support the H2-ECOM Ethernet communications module. Any PLC on an ECOM network can initiate communications with another PLC or use *Direct*SOFT32 to program any PLC on the network. This is the fastest data transfer rate we offer for HMI or other Windows-based software. When monitoring your PLC, you will notice much faster updates using the ECOM module. The H2-ECOM module supports the industry standard 10BaseT with an RJ45 port. The H2-ECOM-F has ST-style bayonet connectors for 10BaseFL fiber optic connections. The ECOM modules use standard cables, hubs and repeaters which are available from a large number of suppliers. A virtually unlimited number of PLCs can be connected to an Ethernet network using ECOM modules.

Serial networking with the D2-DCM

The D2-260, D2-250-1, and D2-240 CPUs support the D2-DCM Data Communications Module, which can serve as a *Direct*Net master/slave, *Direct*Net peer, or a MODBUS RTU slave. The D2-DCM supports both RS-232C and RS-422. You can program the CPU through the DCM locally, or if a PC is the RS-422 master, you can use *Direct*SOFT32 to program any PLC on the network.

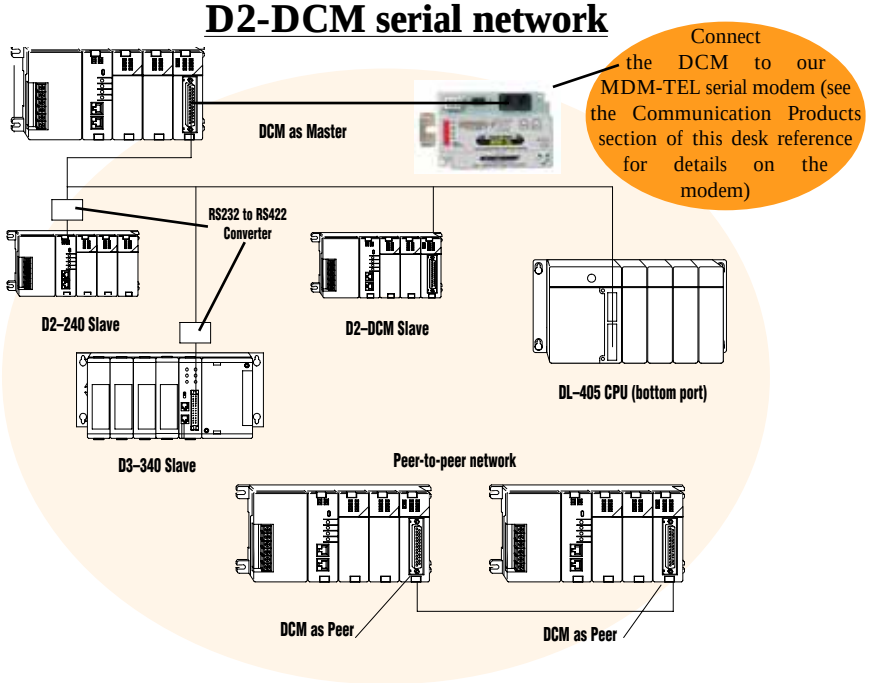
H2-ECOM Ethernet network


PCs running DirectSoft 32 PLC programming software, DSData or HMI software
E-SW05-U Ethernet Switch (see the Communications Products section of this desk reference for details)
D2-260, D2-250-1, or D2-240
H2-ECOM
D4-450, D4-440, or D4-430
H4-ECOM
H2-ECOM

The H2-ECOM can be used for:

- High-speed peer-to-peer networking of PLCs (any PLC can initiate communications)
- CPU programming with ***Direct***SOFT32 Programming Software
- High-speed data acquisition via HMI, DSData Server, Lookout***Direct*** or other HMI software
- Virtually unlimited number of network nodes
- Very easy to setup

D2-DCM serial network


Connect the DCM to our MDM-TEL serial modem (see the Communication Products section of this desk reference for details on the modem)
DCM as Master
RS232 to RS422 Converter
D2-240 Slave
D2-DCM Slave
DL-405 CPU (bottom port)
D3-340 Slave
Peer-to-peer network
DCM as Peer
DCM as Peer

The D2-DCM can be used for:

- ***Direct***Net networking of PLCs (only one DCM or PC can serve as master)
- Peer-to-peer networking of two DCM modules (each can serve as a master or slave)
- CPU programming with ***Direct***SOFT32 Programming Software
- Data acquisition via HMI, DSData Server, Lookout***Direct*** or other HMI software
- A slave on a MODBUS RTU network
- Connection to a serial modem (MDM-TEL)

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Additional Serial Ports for the WinPLC

H2-SERIO serial communications module for the WinPLC

Do you need serial communications ports in addition to the built-in serial port on the WinPLC? Do you need to connect to multiple EZTouch, EZText or other operator interface panels? Would you like to connect devices such as barcode readers, weight scales or serial modems to your WinPLC system? If so, then select the H2-SERIO serial communications module. This module is used exclusively with the WinPLC.

Protocols supported

The H2-SERIO module supports serial ASCII communications and can also serve a Modbus RTU slave.

Up to ten serial ports

The WinPLC has one built-in serial port. Each H2-SERIO module has three serial ports on board. Up to three H2-SERIO modules can be used per WinPLC system. That's a total of ten serial ports that can be used in one WinPLC system to handle all of your serial communications needs.

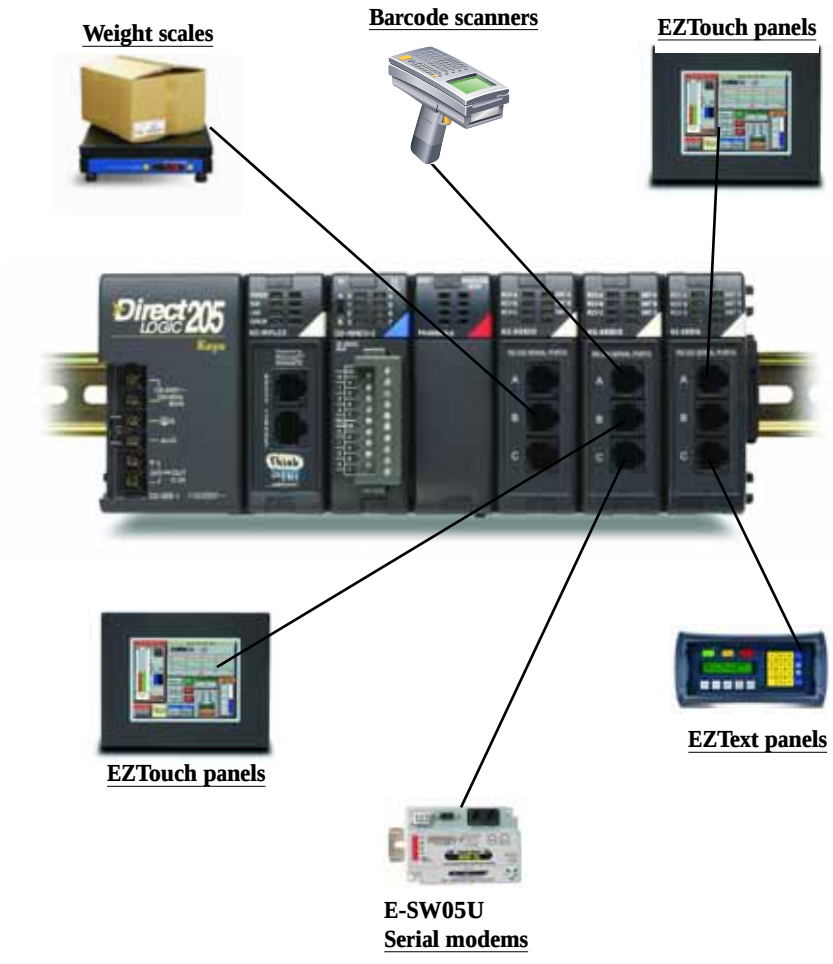
Separate communication parameters for each port

Use Think & Do software packages to set baud rate, parity, data bits, and stop bits for each serial port. Choose from 300 to 57,600 baud communication speeds. Think & Do Studio or Think & Do Live! allows each port to be designated as a MODBUS slave or a generic serial device. Each port on the H2–SERIO module is capable of full hardware handshaking.

Note on processing large amounts of serial data

While the H2-SERIO module will support virtually any serial device, processing large amounts of serial data will increase the system response time. This is important to consider when using multiple H2-SERIO modules, especially in a WinPLC local base with an H2-ERM or H2-CTRIO module.

Connect the WinPLC / H2-SERIO system to a variety of serial ASCII devices.



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STEP 4: SELECT THE I/O MODULES

There are several factors you should consider when choosing an I/O module.

1. Environmental specifications: What environmental conditions will the I/O module be subjected to?

2. Hardware specifications: Does this product have the right features, performance and capacity to adequately serve your application?

3. Field termination: How does this module connect to field devices? Do you need a sinking or sourcing DC module?

4. Power budget: It is very important that your module selections operate within the base power budget. Refer to the power budget description later in this section.

Check the environmental specifications

The following table lists the environmental specifications that globally apply to the DL205 system (CPUs, bases, and I/O modules). Be sure the modules you choose are operated within these environmental specifications.

Specifications and ratings

Storage temperature*
-4ºF – 158ºF (-20ºC to 70ºC)
Ambient operating temperature**
32ºF – 131ºF (0º to 55ºC)
Ambient humidity
30% - 95% relative humidity (non-condensing)
Vibration resistance
MIL STD 810C, Method 514.2
Shock resistance
MIL STD 810C, Method 516.2
Noise immunity
NEMA (ICS3-304)
Atmosphere
No corrosive gases

**** Storage temperature for the Handheld Programmer is –4º to 158ºF (-20º to 70ºC)***

Storage temperature for the DV-1000 is –4º to 158ºF (-20º to 70ºC)

***** Operating temperature for the Handheld Programmer is 32º to 122ºF (0º to 50ºC)***

Operating temperature for the DV-1000 is 32º to 122ºF (0º to 50ºC)

This logo is placed by each I/O module that supports *ZIP*Link connection systems. (The I/O modules are listed at the end of this section.) See the Connection Systems section of this desk reference for details on *ZIP*Links.

Review I/O hardware specifications

The hardware specifications for every DL205 module are described later in this section.

Take time to understand the specification charts, the derating curves and the wiring diagrams. The module specifications should help you determine if this module is right for your application.

Factors affecting field termination

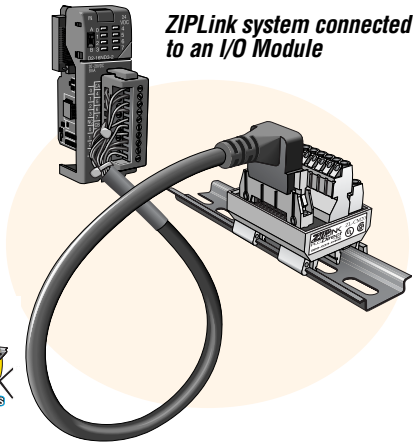
DL205 modules use three types of field terminations. They include a low density removable terminal block (used on modules with eight or fewer points), a high density removable terminal block (European style terminal block available on modules with 12 to 16 points), and a 40-pin connector (for modules with 32 points). The module diagrams indicate the connector type that is on the module. You can also use our super fast and inexpensive *ZIP*Link I/O connector systems.

Module types and suggested AWG range

4 point
16* - 24 AWG
8 point
16* - 24 AWG
12 point
16* - 24 AWG
16 point
16* - 24 AWG
32 point
Ribbon and Solder-style Connectors

**** Note: 16 AWG Type TFFN or Type MTW can be used on 8 pt. modules. Other types of 16 AWG may be acceptable, but it really depends on the thickness of the wire insulation. If the insulation is too thick and you use all the I/O points, then the plastic terminal cover may not close properly.***

***ZIP*Link system connected to an I/O Module**



Need spare parts?

Sometimes it is helpful to have extra I/O module connectors or spare fuses. The DL205 spare parts and accessories are listed below:

- D2-FILL – Filler module for empty slots
- D2-8IOCON – 8-pt. I/O terminal blocks
- D2-16IOCON – 16-pt. I/O terminal blocks
- D2-IOCVR – Spare terminal block covers
- D2-FUSE-1 – Fuses for D2-12TA
- D2-FUSE-3 – Fuses for D2-04TD1, D2-08TA, D2-04TRS, D2-08TR, D2-08CDR
- D2-FUSE-4 Fuses for D2-12TR
- D2-ACC-1 – Base power terminal strip screws
- D2-ACC-2 – Spare terminal screws for 4-pt. and 8-pt. I/O modules
- D2-ACC-3 –Spare terminal screws for 12-pt. and 16-pt. I/O modules
- D4-IO3264R – Ribbon cable connector for 32-pt. modules.
- D4-IO3264S – Solder-type connector for 32-pt. modules.
- **DIN***nectors* and ***ZIP***Links — Refer to the Connection System section of this desk reference for the complete line of products available.

DIN*nectors* terminal blocks

DIN*nectors* are DIN rail mounted connectors or terminal blocks. They provide a means of connecting and identifying two or more wires. All DIN*nectors* are UL, CSA, VDE, SEV, RINA and IEC approved. For more information, refer to the Connection Systems section of this desk reference.

*ZIP*Link connection systems

*ZIP*Links consist of PLC interface cables and connector modules that offer "plug and play" capability by plugging one end of the *ZIP*Link cable into an I/O module and the other end into the *ZIP*Link connector module. This eliminates the tedious process of wiring PLC I/O terminals to terminal blocks individually. For more information, refer to the Connection Systems section of this desk reference to determine compatibility among PLCs, cables and I/O modules.

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I/O Availability

I/0 Availability Table										
PLC CPU / CPU-Slot Controller		**D2-230**	**D2-240**	**D2-250-1**	**D2-260**	**WinPLC**	**Profibus**	**H2-EBC**	**F2-SDS-1**	**F2-DEVNETS-1**
Discrete Modules	*Catalog Pages*	4–31	4–31	4–29	4–26	4–34	4–60	4–52	4–64	4–62
DC Sink/Source In	4–82	√	√	√	√	√	√	√	√*(except 32-pt.)*	√
TTL Input	4–83	√	√	√	√	√	√	√		√
DC Sink Out	4–87	√	√	√	√	√	√	√	√*(except 32-pt.)*	√
DC Source Out	4–88	√	√	√	√	√	√	√	√*(except 32-pt.)*	√
AC Input	4–84	√	√	√	√	√	√	√	√	√
AC Triac Out	4–91	√	√	√	√	√	√	√	√	√
Relay Out	4–93	√	√	√	√	√	√	√	√	√
Isolated Relay Out	4–95	√	√	√	√	√	√	√	√	√
DC In / Relay Out	4–98	√	√	√	√	√	√	√	√	√
Analog Modules										
Analog Current In	4–99	√	√	√	√	√	√	√	√	√
Analog Voltage In	4–102	√	√	√	√	√	√	√	√	√
Analog Current Out	4–107	√	√	√	√	√	√	√	√	√
Analog Voltage Out	4–111	√	√	√	√	√	√	√	√	√
Analog Isolated Current Out	4–109	√	√	√	√	√	√	√	√	√
Analog Isolated Voltage Out	4–113	√	√	√	√	√	√	√	√	√
Combination Analog	4–115	√	√	√	√	√	√	√	√	√
Temperature Input	4–105	√	√	√	√	√	√	√	√	√
Speciality Modules										
Local Expansion	4–48			√	√					
Communications	4–56		√	√	√					
Remote I/O	4–55		√	√	√	√*(H2-ERM)*				
CoProcessor	4–66		√	√	√					
Counter I/O (CTRIO)	4–68		√	√	√	√		√		
Counter Interface	4–76	√	√	√	√					

Sinking and sourcing for DC field devices

If you are using a DC type of field device, then you should consider whether the device is a sinking or sourcing configuration. This may affect your module selection since it determines the manner in which the device must be wired to the module *(*AUTOMATIONDIRECT *offers both sinking and sourcing modules)*. Refer to the sinking/sourcing appendix in this desk reference for a complete explanation on how this affects your system selection.

Analog module selection tips

If you're going to control the speed of an AC inverter or drive with the DL205 analog module, make sure you select either the current sourcing F2-02DAS-1 or voltage sourcing F2-02DAS-2 isolated analog output module. Complete module specifications are listed later in this section.

If you need to operate within a 12 VDC environment, the analog module part numbers that end with (-L) will operate at 12VDC. Most of the other modules require 24VDC.

H2-CTRIO vs. D2-CTRINT high-speed counter module

Select the H2-CTRIO instead of the D2-CTRINT if your application requires:

- More than one quadrature encoder
- More than two single up counters
- Compatibility with the WinPLC
- High-speed inputs or outputs > 5kHz
- Output operations on the module based on counts without interacting with the CPU

The CTRIO is configured using "CTRIO Workbench", a Windows-based "Wizard" utility, eliminating the need for ladder logic programming to configure the module. Multiple CTRIO modules can be used in a base to support additional input/output pulse trains.

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STEP 5: CHOOSE AN I/O CONFIGURATION

I/O configurations

The DL205 system offers local, local expansion and remote I/O system configurations. A DL205 system can be developed using a combination of the configuration arrangements. The tables, along with the configuration diagrams, list the number of I/O points, bases, etc. that are available with each configuration.

I/O bases

The (-1) bases are required for local expansion I/O that is supported by the new D2-250-1 and D2-260 CPUs only. These bases can be used in local, local expansion or remote I/O configurations. For all I/O configurations, the (-1) bases will function exactly the same as the previous bases that did not support expansion I/O. The (-1) bases can be used with all DL205 CPUs and the WinPLC. There are four DL205 base sizes (3, 4, 6, and 9-slot), each of which has a built-in power supply.

Local I/O

All of the DL205 CPUs support local I/O. The D2-230 and D2-240 CPUs are limited to one base of local I/O. (The D2-250-1 and the D2-260 CPUs support local expansion bases). All local I/O points are updated on every CPU scan. The I/O count limits are determined by the number of available I/O slots, the I/O module point density, and the power budget available for the system.

Local expansion

The D2-260 supports local expansion up to five total bases (one CPU base and four expansion bases) and the D2-250-1 supports local expansion up to three total bases (one CPU base and two expansion bases). The D2-230/240 CPUs and WinPLCs do not support local expansion I/O. All local and expansion I/O points are updated on every CPU scan. Expansion bases are commonly used when there are not enough slots available in the CPU base, or when the base power budget will be exceeded. Each local expansion base requires the D2-CM module in the CPU slot. The local CPU base requires the D2-EM Expansion Module, as well as each expansion base. The modules are connected using the D2-EXCBL-1.

Ethernet remote I/O

The DL205 Ethernet Remote I/O system allows you to locate I/O bases at a remote distance from the CPU. For many applications, this can reduce wiring costs by allowing I/O points to be located near the devices they are controlling.

The Ethernet Remote Master module (H2-ERM) is placed in an I/O slot of the local CPU base. Ethernet Base Controller (EBC) modules serve as the remote slave units and are placed in the CPU slot of one or more remote bases. You can use standard DL205 modules in the remote bases. The Remote Slaves are connected to the Master using Category 5 UTP cables for cable runs up to 100 meters. Use repeaters to extend distances and hubs to expand the number of nodes. Our fiber optic version uses industry standard 62.5/125 ST-style fiber optic cables and can be run up to 2,000 meters.

Each H2-ERM module can support up to: 16 H2-EBC systems, 16 Terminator I/O EBC systems, 16 fully expanded H4-EBC systems, or any combination of these.

The PLC, ERM and EBC slave modules work together to update the remote I/O points. These three scan cycles are occurring at the same time, but asynchronously. It is recommended that critical I/O points that must be monitored every scan be placed in the CPU base.

ERM Workbench is an easy-to-use Windows-based software utility for configuring the ERM and its remote slaves.

It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its slaves. While Ethernet networks can handle a very large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the slave I/O and the speed of the I/O network. Ensure ERM networks, multiple ERM networks and ECOM/office networks are isolated from one another.

Serial remote I/O

The DL205 Serial Remote I/O system also allows you to locate I/O bases at a remote distance from the CPU.

The Remote Master module (D2-RMSM) is placed in an I/O slot of the local CPU base. The Remote Slave module (D2-RSSS) is placed in the CPU slot of one or more remote bases. You can use standard DL205 modules in the remote bases. The Remote Slaves are connected to the Master module in a daisy-chain manner over a twisted pair communication cable. You can assign input and output addresses to the remote I/O points by using setup logic in your RLL program. The Remote Master polls the slaves and sends the remote I/O information to the CPU. The communication between the Remote Master and the CPU is asynchronous to the CPU scan. For this reason, Remote I/O applications should be limited to those that do not require the Remote I/O points to be updated with every scan.

The number of bases supported depends on your choice of Remote I/O communications protocol, Remote Master (RM-NET) or Slice Master (SM-NET). In SM-NET mode, the communications port on the D2-RSSS remote slave can be used to connect to an operator interface or to program/monitor the CPU with *Direct*SOFT32; however the communication will not be as fast as using a CPU port.

Remote master protocol (RM-NET)– allows you to connect up to seven remote bases to a single master. The baud rate is fixed at 38.4K baud with a total allowable distance of 3,900 feet.

Slice master protocol (SM-NET)– allows you to connect up to 31 remote bases to a single master. The baud rate is selectable over several ranges with a maximum baud rate of 614.4K baud.

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Local and Local Expansion I/O Configurations

Local I/O configurations

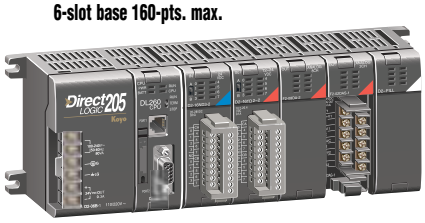
Local I/O Configuration			
CPU	*Total I/O*	*Max. Inputs*	*Max. Outputs*
D2-230	128	128	128
D2-240	256	256	256
D2-250-1	256	256	256
D2-260	256	256	256

Four I/O base configurations to select from

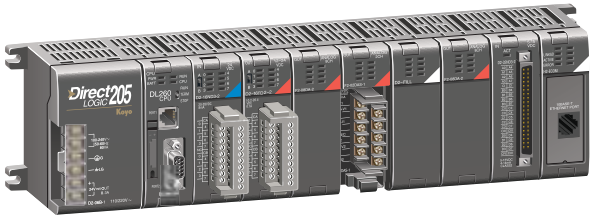
3-slot base 64-pts. max.

4-slot base 96-pts. max.

6-slot base 160-pts. max.



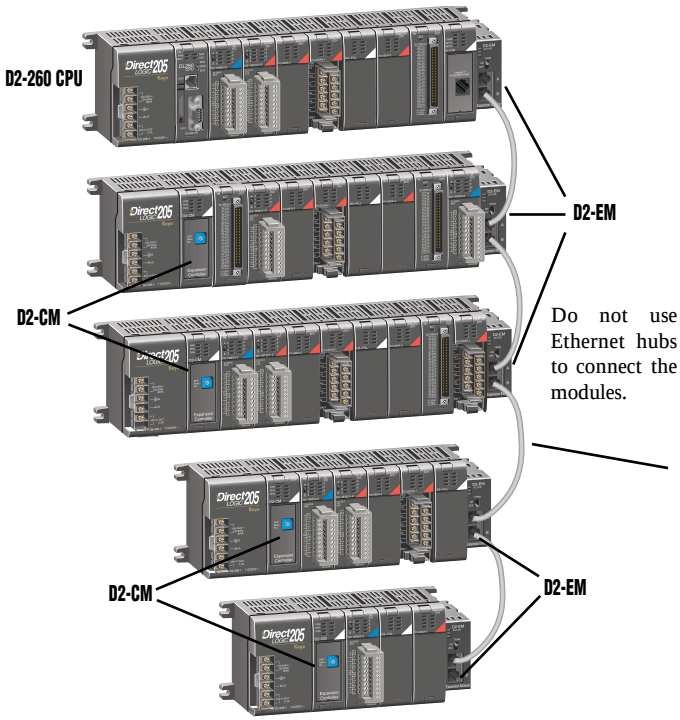
9-slot base 256-pts. max.



Local expansion I/O configurations using D2-EM and D2-CM modules

D2-260 local expansion system

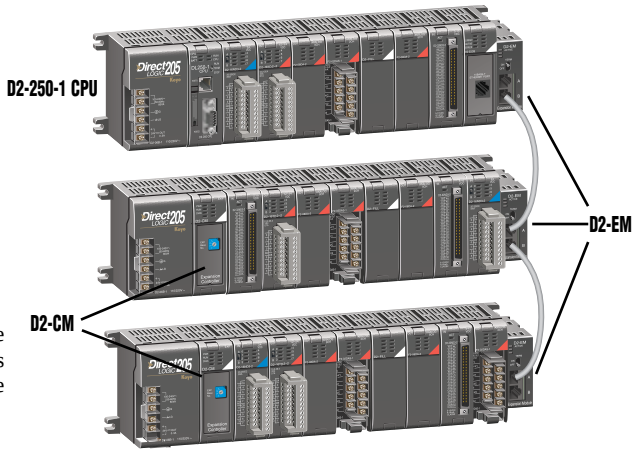
The D2-260 supports local expansion up to five total bases (one CPU base and four expansion bases). All bases in an expansion system must be (-1) bases. The CPU base can be located at any point in the expansion system layout. The maximum total expansion system cable length is 30m (98 ft.). For more information, refer to the Expansion Module specification pages later in this section.



Do not use Ethernet hubs to connect the modules.

D2-250-1 local expansion system

The D2-250-1 supports local expansion up to three total bases (one CPU base and two expansion bases). The CPU base can be located at any point in the expansion system layout. The maximum total expansion system cable length is 30m (98 ft.).



The D2-EXCBL-1 is a Category 5 straight-through cable that connects the D2-EM modules together. The cable can be user made in custom lengths up to 30m depending upon the configuration.

Local Expansion I/O Configuration				
CPU	*# of Exp. Bases*	*Total I/O*	*Max. Inputs*	*Max. Outputs*
D2-250-1	2	768	512	512
D2-260	4	1280	1024	1024

DL-230, DL240 CPUs and WinPLCs do not support local expansion systems

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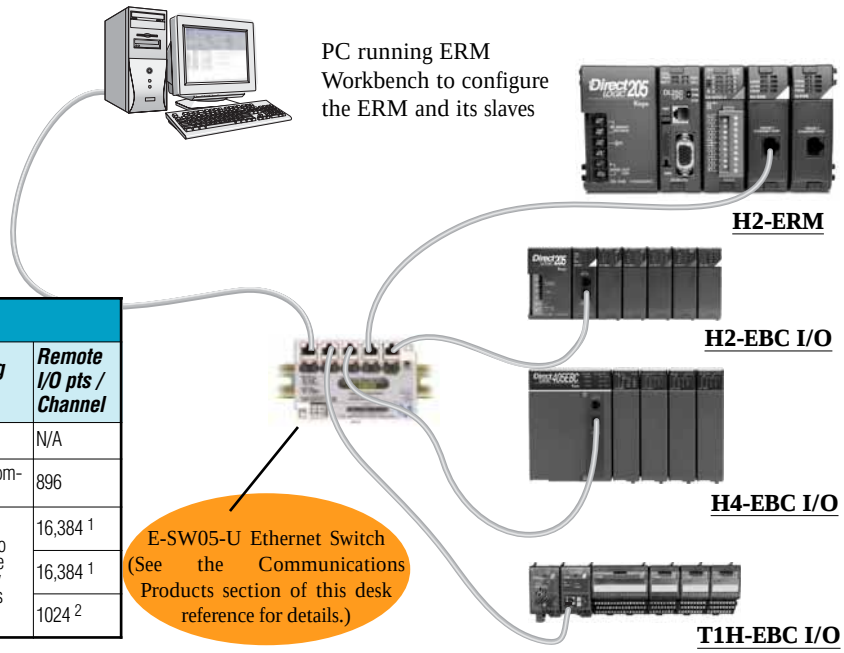
REMOTE I/O CONFIGURATIONS

Ethernet remote I/O configuration using H2-ERM and EBC slaves

Specifications	H2-ERM	H2-ERM-F
Communications	10BaseT Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps	
Link Distance	100 meters (328 ft)	2Km (6560 ft)
Ethernet Port	RJ45	ST-style fiber optic
Ethernet Protocols	TCP/IP, IPX	

Ethernet Remote I/O Configuration					
CPU	Max. # of Channels	Max. # of Slaves/ Channel	Discrete I/O pts.	Analog I/O	Remote I/O pts / Channel
D2-230	N/A	N/A	N/A	N/A	N/A
D2-240	Limited by power budget	16 Slaves (H2-EBC, H4-EBC or T1H-EBC)	limited to 896 by CPU	Not recommended	896
D2-250-1			2048	Map into available memory registers	16,384 [1]
D2-260			8192		16,384 [1]
H2-WPLC*-**	1 / system	1 Slave	256		1024 [2]

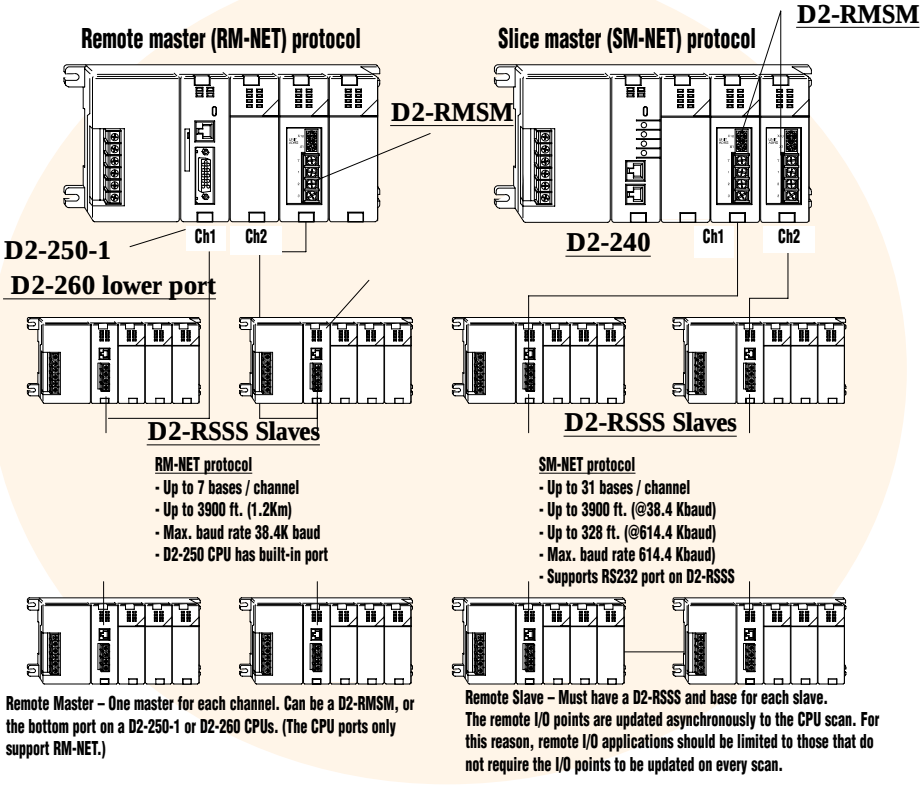

PC running ERM Workbench to configure the ERM and its slaves
H2-ERM
H2-EBC I/O
H4-EBC I/O
T1H-EBC I/O
E-SW05-U Ethernet Switch (See the Communications Products section of this desk reference for details.)

[1] 16,384 I/O pts. can be achieved with 16 fully expanded H4-EBC slaves using V-memory and bit-of-word instructions.
[2] 1024 I/O points can be achieved using 1 fully expanded H4-EBC slave.

Note: It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its slaves. While Ethernet networks can handle a very large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the slave I/O and the speed of the I/O network. Ensure ERM networks, multiple ERM networks and ECOM/office networks are isolated from one another.

Serial remote I/O configuration using D2-RMSM and D2-RSSS

Serial Remote I/O Configuration			
CPU	D2-240	D2-250-1	D2-260
Max. # of Channels	2	7	7
Max. I/O pts. per Channel	896 (limited by CPU)	2048	2048
RM-NET Bases per Channel	7	7	7
SM-NET Bases per Channel	31	31	31
Total Remote I/O pts.	896 (limited by CPU)	2048	8192


Remote master (RM-NET) protocol
Slice master (SM-NET) protocol
D2-RMSM
D2-RMSM
D2-250-1
D2-260 lower port
D2-240
Ch1
Ch2
Ch1
Ch2
D2-RSSS Slaves
D2-RSSS Slaves
RM-NET protocol
- Up to 7 bases / channel
- Up to 3900 ft. (1.2Km)
- Max. baud rate 38.4K baud
- D2-250 CPU has built-in port
SM-NET protocol
- Up to 31 bases / channel
- Up to 3900 ft. (@38.4 Kbaud)
- Up to 328 ft. (@614.4 Kbaud)
- Max. baud rate 614.4 Kbaud
- Supports RS232 port on D2-RSSS
Remote Master – One master for each channel. Can be a D2-RMSM, or the bottom port on a D2-250-1 or D2-260 CPUs. (The CPU ports only support RM-NET.)
Remote Slave – Must have a D2-RSSS and base for each slave. The remote I/O points are updated asynchronously to the CPU scan. For this reason, remote I/O applications should be limited to those that do not require the I/O points to be updated on every scan.

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I/O Addressing Schemes

DL205 I/O addressing scheme

You may have used other PLC systems prior to trying *Direct*LOGIC products. One of the key differences between various PLC systems is the I/O module addressing. This section will show you how we address the individual I/O points in a DL205 system.

Octal addressing

The DL205 uses octal addressing. That is, the I/O point addresses do not include any "8s" or "9s". The I/O points start at 0 and continue in increments of 8 or 16 points, depending on the modules being used. We have designated "X" for inputs and "Y" for outputs.

Note: 4-point modules consume eight points, but only the first four points are actually used by the module. 12-point modules consume sixteen points, but only twelve points are used. The first six points are used, then two points are skipped, then the next six points are used, and the last two are skipped.

Automatic addressing

The DL205 CPUs automatically examine local I/O modules to establish the correct I/O addressing on power-up. The D2-250-1 and D2-260 CPUs automatically examine I/O modules in expansion bases as well. The modules don't have to be grouped by type and can typically be mixed in any order. However, there are restrictions placed on some specialty modules or combinations of modules (see the next page). The diagram to the right shows sample addresses for a simple system that contains a few discrete I/O modules.

Manual addressing

The D2-250-1 and D2-260 CPUs allow you to manually assign I/O addresses for any or all I/O slots on the local or expansion bases. This feature is useful if you have a standard configuration that you need to change slightly to accommodate a special request (i.e. adding or removing I/O modules from a system). Manual addresses are based on 16-point boundaries.

Remote I/O addressing

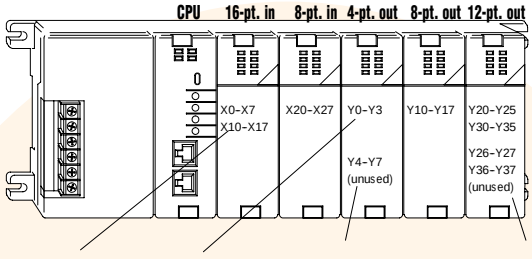
Remote I/O allows you to assign addresses manually. You can choose the data type for the remote points. Ethernet remote I/O (H2-ERM) allows you to map the analog I/O channels directly into V-memory (16-bit words) while mapping the discrete I/O points into input/output bit memory (Xs & Ys). Serial remote I/O (D2-RMSM) allows you to assign one starting address for all of the input modules and one starting address for the output modules.

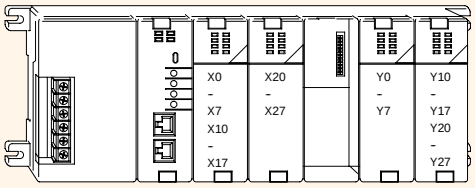
Leaving empty slots

You may be tempted to leave empty slots for future expansion. This is perfectly acceptable, but it is very important that you understand the implications of placing a module in the empty slot at a later time.

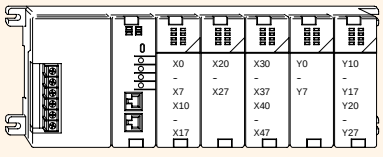
Since the CPU automatically assigns the I/O addresses, it is possible to cause problems by adding a module to the system. Examine the example system shown below. If you added an input module to the empty slot, the new input addresses would start after the existing input addresses, so no problems would occur. However, if you added an output to the empty slot, your remaining output addresses would change. Therefore, you would have to edit your RLL program to reflect the address changes. The manual addressing feature supported by the D2-250-1 and D2-260 is especially useful when adding an I/O module between existing I/O modules or removing a module.

You should always add extra modules to the right of existing modules of the same type to avoid any re-addressing of your I/O points.

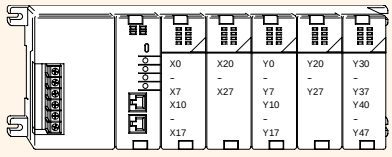




I/O base with a slot left empty. The examples below show the addressing changes if an input or an output module is added to the system.



Add Input module. Addresses follow existing, so no program modification is required.



Add output module. Addresses are re-numbered and program modification is required.

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MODULE PLACEMENT AND I/O USAGE TABLES

Verify planned I/O module locations

There are very few I/O module placement restrictions in the DL205 family. In general, any mix of analog and discrete module types can be used in any local, expansion or remote base. However, there are a few situations with the specialty modules that warrant some special considerations. Reference the Module Placement Restrictions table to the right for the DL205.

Analog I/O with a D2-230 CPU

DL205 analog modules map into the CPU as 16-point discrete modules. (They actually consume discrete I/O points.) With a D2-240, D2-250(-1) or D2-260 CPU, analog I/O modules can reside in any I/O slot. If you are using a D2-230 CPU, then the analog module must start on one of the word addresses boundaries. (You may have to rearrange your modules to ensure this happens.)

I/O point usage

The table to the right indicates the number of I/O points consumed by each module. Use this information to ensure you stay within the maximum I/O count of the I/O system you have chosen.

Module Placement Restrictions

Module/Unit	Local CPU Base	Local Expansion	Remote Base
CPUs	CPU slot only		
DC Input	✓	✓	✓
AC Input	✓	✓	✓
DC Output	✓	✓	✓
AC Output	✓	✓	✓
Relay Output	✓	✓	✓
Analog Input & Output[1]	✓	✓	✓
Local Expansion (D2-260 & D2-250-1 only)			
Base Expansion Unit (D2-EM)	✓	✓	
Base Controller Unit (D2-CM)		CPU slot only	
Remote I/O			
Remote Master	✓		
Remote Slave Unit			CPU slot only
Ethernet Remote Master	✓		
CPU Device			
Ethernet Base Controller	CPU slot only		
WinPLC	CPU slot only		
DeviceNET	CPU slot only		
Profibus	CPU slot only		
SDS	CPU slot only		
Specialty modules			
Counter Interface (D2-CTRINT)	Slot 0 only		
Counter I/O (H2-CTRIO)[2]	Any slot except Slot 0		
Simulator	✓	✓	✓
Data Communications	Any slot except Slot 0		
Ethernet Communications	Any slot except Slot 0		
Basic CoProcessor	Any slot except Slot 0		

[1] With a D2-230 CPU, the analog module must start on one of the word address boundaries.
[2] H2-CTRIO will not work in slot 0 when used with the DL-240, DL-250-1, DL-260. The H2-CTRIO is not supported in expansion bases at this time. The H2-CTRIO will work in slot 0 if used with one of the H2-WPLC units.

I/O Module Point Usage

DC INPUT		RELAY OUTPUT		SPECIALTY MODULES	
D2-08ND3	8 in	D2-04TRS	8* out	D2-EX	None
D2-16ND3-2	16 in	D2-08TR	8 out	D2-CM	None
D2-32ND3	32 in	F2-08TR	8 out	F2-08SIM	8 in
D2-32ND3-2	32 in	F2-08TRS	8 out	D2-CTRINT	8 in 8 out
		D2-12TR	16** out	H2-CTRIO	None
				D2-DCM	None
				F2-DEVNETS-1	None
				F2-SDS-1	None
				H2-EBC	None
				H2-EBC-F	None
				H2-ECOM	None
				H2-ECOM-F	None
				F2-CP128	None
				H2-PBC	None
AC INPUT		**COMBINATION**		**REMOTE I/O**	
D2-08NA-1	8 in	D2-08CDR	8 in*/8 out*	H2-ERM	None
D2-08NA-2	8 in			D2-RMSM	None
D2-16NA	16 in			D2-RSSS	None
DC OUTPUT		**ANALOG**			
D2-04TD1	8* out	F2-04AD-1 & 1L	16 in		
D2-08TD1	8 out	F2-04AD-2 & 2L	16 in		
D2-08TD2	8 out	F2-08AD-1	16 in		
D2-16TD1-2	16 out	F2-08AD-2	16 in		
D2-16TD2-2	16 out	F2-02DA-1 & 1L	16 out		
D2-32TD1	32 out	F2-02DA-2 & 2L	16 out		
D2-32TD2	32 out	F2-4AD2DA	16 in/16 out		
AC OUTPUT		F2-02DAS-1	32 out		
D2-08TA	8 out	F2-02DAS-2	32 out		
F2-08TA	8 out	F2-08DA-1	16 out		
D2-12TA	16** out	F2-08DA-2	16 out		
		F2-04RTD	32 in		
		F2-04THM	32 in		

** 4-pt. modules consume eight points. Only the first four points are used.*

*** 12-pt. modules consume 16 points. The first six points are assigned, two are skipped, and then the next six points are assigned. For example, a D2-12TA installed in slot 0 would use Y0-Y5, and Y10-Y15. Y6-Y7, and Y16-Y17 would be unused.*

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Step 6: Check the Power Budget

Managing your power resource

When determining the types and quantity of I/O modules you will be using, it is important to remember there is a defined amount of power available from the base power supply.

The chart on the next page indicates the power supplied and used by each DL205 device. The adjacent chart shows an example of how to calculate the power used by your particular system. These charts should make it easy for you to determine if the devices you have chosen will operate within the power budget of your system configuration.

If the I/O you have chosen exceeds the maximum power available from the power supply, you may be able to resolve the problem by using local expansion or remote I/O bases.

DL205 power supply specifications

The table below lists base power supply specifications, including maximum inrush current and maximum power consumed from your power source.

Power budget example

The example below shows how to calculate the power budget for the DL205 system. The examples are constructed around a single 9-slot base using the devices shown. It is recommended you construct a similar table for your DL205 system. Follow the steps to the right to determine your power budget.

1. Using a chart similar to the one below, fill in column 2.
2. Using the tables on the next page, enter the current supplied and used by each device (columns 3 and 4). Devices which fall into the "Other" category (Row D) are devices such as the operator interface and the handheld programmer, which also have power requirements, but do not directly plug into the base.
3. Add the current used by the system devices (columns 3 and 4) starting with the CPU slot and put the total in the row labeled "Maximum Current Required" (Row E).
4. Subtract the row labeled "Maximum Current Required" (Row E), from the row labeled "Current Supplied" (Row B). Place the difference in the row labeled "Remaining Current Available" (Row F).
5. If "Maximum Current Required" is greater than "Current Supplied" in either column 3 or 4, the power budget will be exceeded. It will be unsafe to use this configuration, and you will need to restructure your I/O configuration. Note the auxiliary power supply does not need to supply all the external power. If you need more than the 300mA supplied, you can add an external 24V power supply. This will help keep you within your power budget for external power.

A	Column 1	Column 2	Column 3	Column 4
		Device Type	5 VDC (mA)	External Power 24 VDC (mA)
B	CURRENT SUPPLIED			
	Base	9 slot	2,600	300
C	CURRENT REQUIRED			
	CPU SLOT SLOT 0 SLOT 1 SLOT 2 SLOT 3 SLOT 4 SLOT 5 SLOT 6 SLOT 7	D2-260 (CPU) D2-16ND3-2 D2-16ND3-2 D2-16NA D2-08NA-1 D2-16TD1-2 D2-08TA D2-08TA	330 100 100 100 50 200 250 250	0 0 0 0 0 80 0 0
D	OTHER			
	Operator interface Handheld programmer	DV-1000 D2-HPP	150 200	0 0
E	Maximum Current Required		1730	80
F	Remaining Current Available		2600-1520=1080	300-80=220

Power Supply Specifications			
Specification	AC Powered Bases	24 VDC Powered Bases	125 VDC Powered Bases
Part Numbers	D2-03B-1, D2-04B-1, D2-06B-1, D2-09B-1	D2-03BDC1-1, D2-04BDC1-1, D2-06BDC1-1, D2-09BDC1-1	D2-03BDC-2, D2-04BDC-2, D2-06BDC2-1, D2-09BDC2-1
Voltage Withstand (dielectric)	1 minute @ 1,500 VAC between primary, secondary, field ground, and run relay		
Insulation Resistance	> 10M at 500 VDC		
Input Voltage Range	85-132 VAC (110 range) 170-264 VAC (220 range) 47-63Hz	10.2 - 28.8VDC (24VDC) with less than 10% ripple	100-264VDC (125 VDC) with less than 10% ripple
Auxiliary 24 VDC Output	300mA max.	none	300mA max.
Maximum Inrush Current	30A	10A	20A
Maximum Power	80 VA	25W	30W

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POWER REQUIREMENTS

These charts help determine your power requirements

This section shows the amount of power supplied by each of the base power supplies and the amount of power consumed by each DL205 device. The Power Consumed charts list how much INTERNAL power from each power source is required for the DL205 devices. Use this information when calculating the power budget for your system.

In addition to the internal power sources, the DL205 bases offer a 24VDC auxiliary power supply with external power connections. This auxiliary power supply can power external devices.

Use *ZIP*Links to reduce 5VDC base power requirements

If your application requires a lot of relay outputs, consider using the *ZIP*Link AC or DC relay output modules. These modules can switch high current (10A) loads without putting a load on your 5VDC base power budget.

For example, an 8-point F2-08TRS relay output module requires 670mA @ 5VDC. If you used a D2-16TD1-2 DC output module instead to drive a *ZIP*Link relay block, you would only use 200mA @ 5VDC, and you'd have eight more relay outputs at a higher rated load current switching capacity. Refer to the Connection Systems section of this desk reference to find out more about *ZIP*Link cables and connector modules.

This logo is placed by the I/O modules that are supported by the *ZIP*Link connection systems. See the I/O module specifications at the end of this section.

Power Supplied							
Device	**Price**	**5V(mA)**	**24V Auxiliary**	**Device**	**Price**	**5V(mA)**	**24V Auxiliary**
Bases				***Bases***			
D2-03B-1	<--->	2600	300	D2-06BDC1-1	<--->	2600	None
D2-03BDC1-1	<--->	2600	None	D2-06BDC2-1	<--->	2600	300
D2-04B-1	<--->	2600	300	D2-09B-1	<--->	2600	300
D2-04BDC1-1	<--->	2600	None	D2-09BDC1-1	<--->	2600	None
D2-06B-1	<--->	2600	300	D2-09BDC2-1	<--->	2600	300

Power Consumed		
Device	**5V(mA)**	**24V Auxiliary**
CPUs		
D2-230	120	0
D2-240	120	0
D2-250-1	330	0
D2-260	330	0
H2-WPLC*-**	680	0
DC Input Modules		
D2-08ND3	50	0
D2-16ND3-2	100	0
D2-32ND3	25	0
D2-32ND3-2	25	0
AC Input Modules		
D2-08NA-1	50	0
D2-08NA-2	100	0
D2-16NA	100	0
Input Simulator Module		
F2-08SIM	50	0
DC Output Modules		
D2-04TD1	60	20
D2-08TD1	100	0
D2-08TD2	100	0
D2-16TD1-2	200	80
D2-16TD2-2	200	0
D2-32TD1	350	0
D2-32TD2	350	0
AC Output Modules		
D2-08TA	250	0
F2-08TA	250	0
D2-12TA	350	0
Relay Output Modules		
D2-04TRS	250	0
D2-08TR	250	0
F2-08TR F2-08TRS	670 670	0 0
D2-12TR	450	0
Combination In/Out Module		
D2-08CDR	200	0

Power Consumed		
Device	**5V(mA)**	**24V Auxiliary**
Analog Modules		
F2-04AD-1	50	80
F2-04AD-1L	50	90mA @ 12V
F2-04AD-2	60	80
F2-04AD-2L	60	90mA @ 12V
F2-08AD-1	50	80
F2-08AD-2	50	80
F2-02DA-1	40	60 (note 1)
F2-02DA-1L	40	70 @ 12V (note 1)
F2-02DA-2	40	60
F2-02DA-2L	40	70 @ 12V
F2-02DAS-1 F2-02DAS-2	100 100	50 / channel 60 / channel
F2-08DA-1	30	50 (note 1)
F2-08DA-2	60	140
F2-4AD2DA	60	80 (note 1)
F2-04RTD	90	0
F2-04THM	110	60
Specialty Modules		
D2-CTRINT	50*	0
D2-CM / D2-EM	100/130	0
H2-CTRIO	400	0
D2-DCM	300	0
F2-DEVNETS	160	0
F2-SDS-1	160	0
H2-PBC	530	0
H2-EBC(-F)	450, (640)	0
H2-ECOM(-F)	320, (450)	0
F2-CP128	235	0
Remote I/O		
H2-ERM(-F)	320, (450)	0
D2-RMSM	200	0
D2-RSSS	150	0
Programming Devices		
D2-HPP	200	0
*requires external 5VDC for outputs Note 1: add an additional 20mA per loop		

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DIMENSIONS AND INSTALLATION

It is important to understand the installation requirements for your DL205 system. This will help ensure that the DL205 products operate within their environmental and electrical limits.

Plan for safety

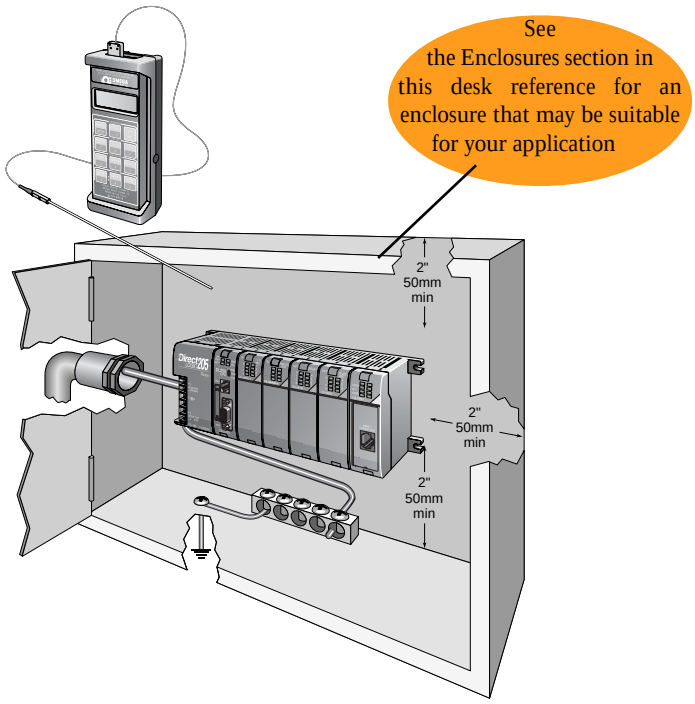
This desk reference should never be used as a replacement for the user manual. The user manual, D2-USER-M (sold separately), contains important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

Environmental specifications

The Environmental Specifications table at the right lists specifications that apply globally to the DL205 system (CPUs, bases, and I/O modules). Be sure that the DL205 system is operated within these environmental specifications.

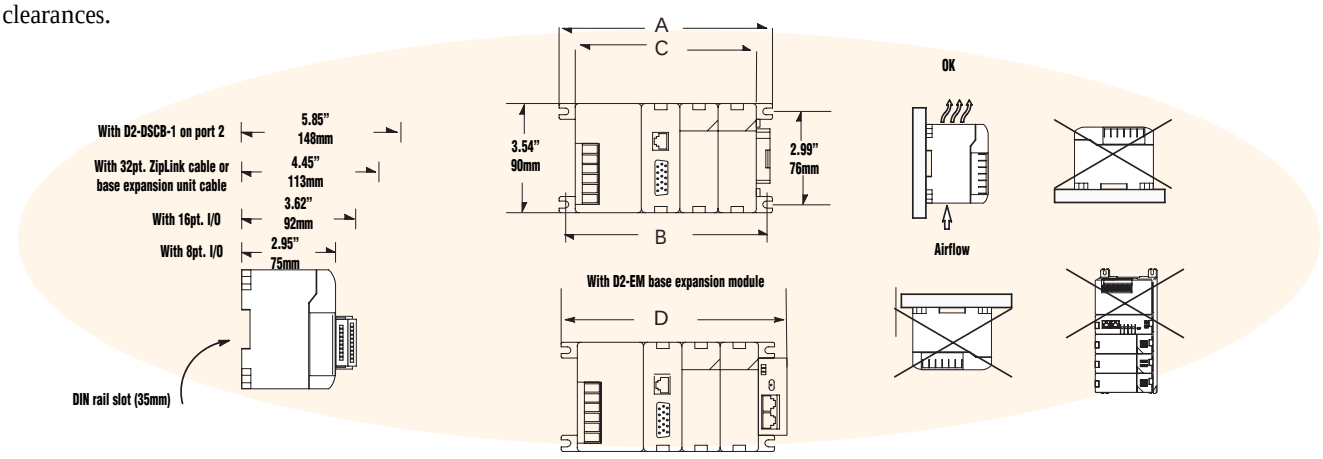
Base dimensions and mounting

Use the diagrams below to make sure the DL205 system can be installed in your application. To ensure proper airflow for cooling purposes, DL205 bases must be mounted horizontally. It is important to check these dimensions against the conditions required for your application. For example, it is recommended that approximately 3" of space is left in front PLC surface for ease of access and cable clearances. Also, check the installation guidelines for recommended cabinet clearances.


See the Enclosures section in this desk reference for an enclosure that may be suitable for your application
2" 50mm min
2" 50mm min
2" 50mm min

Environmental Specification	Rating
Storage Temperature	-4°F - 158°F (-20°C to 70°C)
Ambient Operating Temperature	32°F - 131°F (0°C to 55°C)
Ambient Humidity	30%-95% relative humidity (non-condensing)
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD 810C, Method 516.2
Noise Immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

Base	A		B		C		D	
D2-03B-1, D2-03BDC1-1, D2-03BDC-2	6.77"	172mm	6.41"	163mm	5.8"	148mm	7.24"	184mm
D2-04B-1, D2-04BDC1-1, D2-04BDC-2	7.99"	203mm	7.63"	194mm	7.04"	179mm	8.46"	215mm
D2-06B-1, D2-06BDC1-1, D2-06BDC2-1	10.43"	265mm	10.07"	256mm	9.48"	241mm	10.90"	277mm
aD2-09B-1, D2-09BDC1-1, D2-09BDC2-1	14.09"	358mm	13.74"	349mm	13.14"	334mm	14.56"	370mm



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LOCAL EXPANSION MODULES

Base Expansion Module
D2-EM <--->

Expansion Base Controller Module
D2-CM <--->

D2-EM Expansion Module Specifications	
Module Type	Base expansion unit
I/O Slots Consumed	None; attaches to right side of (-1) bases
I/O Points Consumed	None
Expansion Connectors	Two 8-pin RJ45
Cable	Category 5 with RJ45 connectors (straight-through)
Maximum Cable Length	30m (98ft.) total expansion system
Power Consumption	130mA @ 5VDC (supplied by base)
Operating Environment	0ºC to 60ºC (32ºF to 140ºF), 5% to 95% humidity (non-condensing)

D2-CM Controller Module Specifications	
Module Type	Expansion base controller module
Modules per Base	One, CPU slot of (-1) base only
I/O Points Consumed	None
Expansion Base Number Select Switch	Rotary switch select 1-4 in any order
Power Consumption	100mA @ 5VDC (supplied by base)
Operating Environment	0ºC to 60ºC (32ºF to 140ºF), 5% to 95% humidity (non-condensing)

CPU Supported / I/O Points				
CPU	*# of Exp. Bases*	*Total I/O**	*Max. Inputs*	*Max. Outputs*
D2-260	4	1280	1024	1024
D2-250-1	2	768	512	512
D2-240	These CPUs do not support local expansion systems.			
D2-230				
H2-WPLC-***				

* Includes CPU base and local expansion bases

New local expansion modules

The D2-260 supports local expansion up to five total bases (one CPU base + four expansion bases), and the D2-250-1 supports local expansion up to three total bases (one CPU base + two expansion bases). Expansion bases are commonly used when there are not enough slots available in the CPU base, when the base power budget will be exceeded, or when placing an I/O base at a location away from the CPU base but within the expansion cable limits. All local and expansion I/O points are updated with every CPU scan.

Expansion base I/O addressing is based on the numerical order of the D2-CM rotary switch selection. The CPU recognizes the expansion bases on power-up.

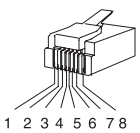
Local expansion requires (-1) bases

The (-1) I/O bases must be used in local expansion systems. Each expansion base requires that the D2-CM module is placed in the CPU slot. The CPU base and each expansion base require the D2-EM unit that attaches to the right side of the (-1) bases.

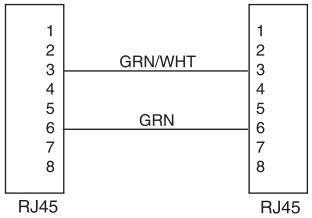
D2-EXCBL-1 local expansion base cable

The category 5 straight-through D2-EXCBL-1 (1m) is used to connect the expansion modules together. If longer cable lengths are required, we recommend that you purchase commercially manufactured cables with RJ45 connectors already installed. The maximum total expansion system cable length is 30m (98 ft.).

8-pin RJ45 Connector
8P8C



D2-EM to D2-EM Cable Pin-outs
(Use Category 5 straight-through cable)



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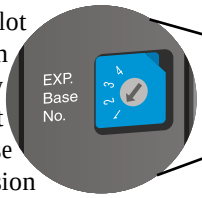
Local Expansion Modules

D2-CM Expansion Base Controller Module

The D2-CM module is placed in the CPU slot of each expansion base. The rotary switch is used to select the expansion base number. The expansion base I/O addressing (Xs & Ys) is based on the numerical order of the rotary switch selection and is recognized by the CPU on power-up. Duplicate expansion base numbers will not be recognized by the CPU. An example of base I/O addressing order is shown to the right.



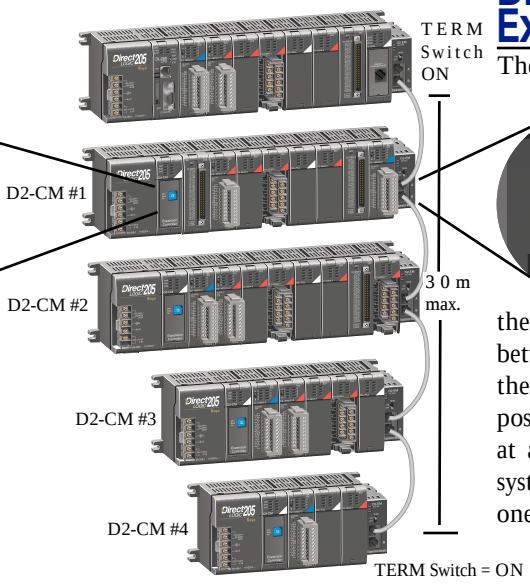
D2-260 expansion system

The D2-260 supports local expansion up to five total bases (one CPU base + four expansion bases) and up to a maximum of 1280 total I/O points. All local and expansion I/O points are updated on every CPU scan. No specialty modules can be located in the expansion bases. Refer to the Module Placement Table earlier in this section for restrictions. The maximum total expansion system cable length is 30m (98 ft.). The red text and arrows in the example to the right indicate the I/O addressing order.

D2-250-1 expansion system

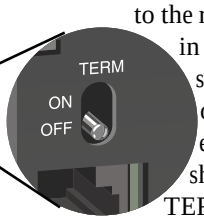
The D2-250-1 supports local expansion up to three total bases (one CPU base + two expansion bases) and up to a maximum of 768 total I/O points. All local and expansion I/O points are updated on every CPU scan. The D2-250-1 does not support the use of specialty modules located in the expansion bases. The maximum total expansion system cable length is 30m (98 ft.). The red text and arrows in the example to the right indicate the I/O addressing order.

D2-260 expansion system

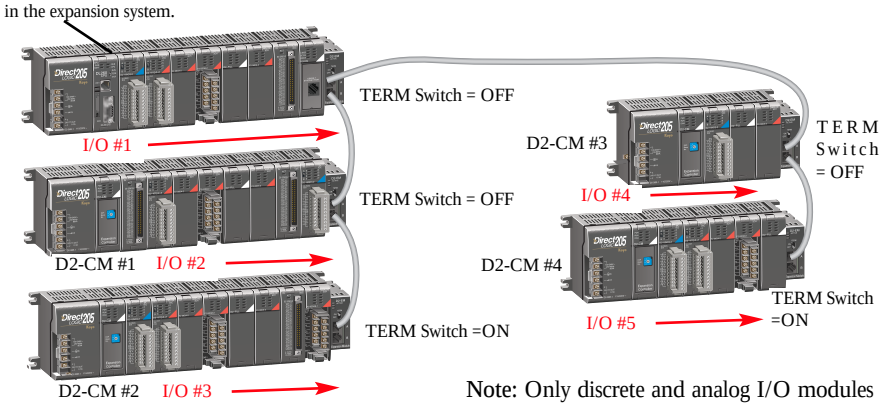


D2-EM Base Expansion Module

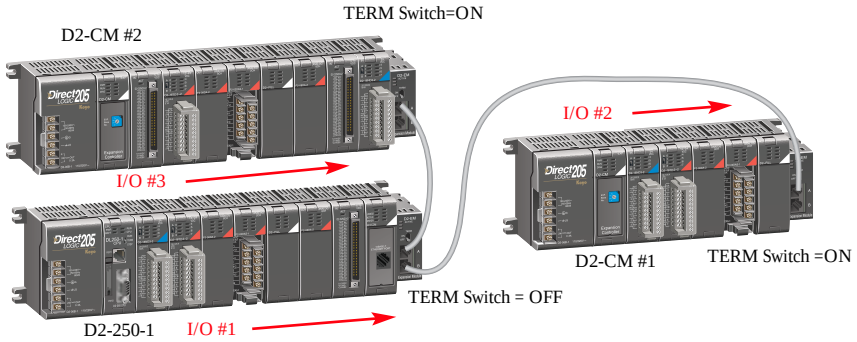
The D2-EM expansion unit is attached to the right side of each base in the expansion system. The D2-EMs on each end of the expansion system should have the TERM switch placed in the ON position. The expansion units between the end-most units should have the TERM switch placed in the OFF position. The CPU base can be located at any base position in the expansion system. It does not have to be located at one end or the other.



The D2-260 CPU base can be located at any base position in the expansion system.



Note: Only discrete and analog I/O modules are supported on the expansion bases. No specialty or communications modules can be used on the expansion bases at this time.



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ETHERNET VS. SERIAL REMOTE I/O

I/O throughput

I/O throughput is defined as the time it takes from when an output is set in the ladder logic to when its corresponding input value is equal. This includes the PLC scan time, I/O backplane update time, and I/O module response times.

Testing I/O throughput times

A test was performed by our partner, Host Automation Products, to compare the difference between H2-ERM Ethernet remote I/O and D2-RMSM serial remote I/O throughput times. Host Automation Products supplies the H2-ERM, H2-EBC, H2-ECOM, etc. as well as *Direct*SOFT32 and DSData Server software.

I/O groups tested

Discrete I/O - D2-16TD1-2 discrete outputs of slot 2 are tied to the D2-16ND3-2 discrete inputs of slot 0.

Analog I/O - F2-02DAS-2 analog output channel 1 is tied to the F2-04AD-2 analog input channel 1 of slot 3. The analog values were scaled from the full 16- bit range down to 12 bit range.

Each group was run independently through the following cycle 256 times:

Step 1: Set all outputs to OFF for a random number of scans

Step2: Set all outputs to a random value for a random number of scans

Step 3: Set all outputs to ON for a random number of scans

Step 4: Set all outputs to a random value for a random number of scans

Since these four steps are repeated 256 times, there are actually 1024 samples of I/O throughput.

Test results

The results are listed in the tables at the right. As the number of H2-ERM slaves and I/O points increase, the I/O throughput times will remain flat until 64 analog inputs, 64 analog outputs, or 1024 discrete I/O points are exceeded. As the number of D2-RMSM slaves and I/O points increase, the I/O throughput times increase proportionally.

H2-ERM / H2-EBC Ethernet Remote I/O System

D2-RMSM / D2-RSSS Serial Remote I/O System

Discrete I/O Test	I/O Throughput Times			
Remote I/O System	*Min.*	*Max.*	*Avg.*	*Std. Dev.*
H2-ERM / H2-EBC	45ms	71ms	53.32ms	6.14ms
D2-RMSM / D2-RSSS	36ms	56ms	42.29ms	5.81ms

Analog I/O Test	I/O Throughput Times			
Remote I/O System	*Min.*	*Max.*	*Avg.*	*Std. Dev.*
H2-ERM / H2-EBC	46ms	113ms	62.94ms	14.48ms
D2-RMSM / D2-RSSS	64ms	321ms	117.38ms	37.44ms

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Ethernet Remote I/O Master Module

Ethernet Remote I/O Master Module

H2-ERM <--->
H2-ERM-F <--->

Overview

The Ethernet Remote Master H2-ERM (-F) connects 240, 250-1 and 260 CPU systems to slave I/O over a high-speed Ethernet link. The H2-ERM can also be used in a WinPLC system, but only one H2-ERM can be used with one slave per system.

Need a lot of I/O?

Each ERM module can support up to 16 additional H2-EBC systems, 16 Terminator I/O EBC systems, or 16 fully expanded H4-EBC systems. Of course, combinations are fine, too. The ERM also supports Edrives. See the Drives section for details.

Note: Applications requiring an extremely large number of T1H-EBC analog I/O or H4-EBC 16-channel analog I/O, could exceed the buffer capacity of a single H2-ERM module. In these cases, an additional H2-ERM may be required.

Specifications	H2-ERM	H2-ERM-F
Communications	10BaseT Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps	
Link Distance	100 meters (328 ft)	2K meters (6560 ft)
Ethernet Port	RJ45	ST-style fiber optic
Ethernet Protocols	TCP/IP, IPX	
Power Consumption	320mA @5VDC	450mA @5VDC
Manufacturer	Host Automation Products, L.L.C.	

Simple connections

The ERM connects to your control network using Category 5 UTP cables for cable runs up to 100 meters. Use repeaters to extend distances and expand the number of nodes. Our fiber optic version uses industry standard 62.5/125 ST-style fiber optic cables and can be run up to 2,000 meters.

The PLC, ERM and EBC slave modules work together to update the remote I/O points. These three scan cycles are occurring at the same time, but asynchronously. Critical I/O points that must be monitored every scan are best placed in the CPU base.

Networking ERMs with other Ethernet devices

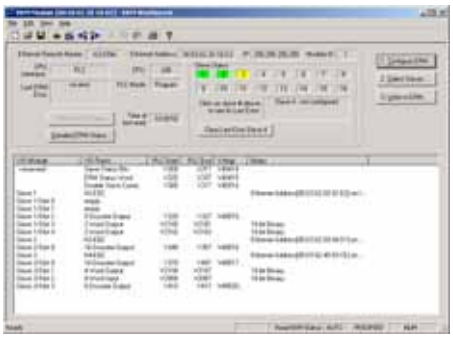
It is highly recommended that a dedicated Ethernet remote I/O network be used for the ERM and its slaves. While Ethernet networks can handle a large number of data transactions, and normally handle them very quickly, heavy Ethernet traffic can adversely affect the reliability of the slave I/O and the speed of the I/O network. Ensure ERM networks, multiple ERM networks and ECOM/office networks are isolated from one another.

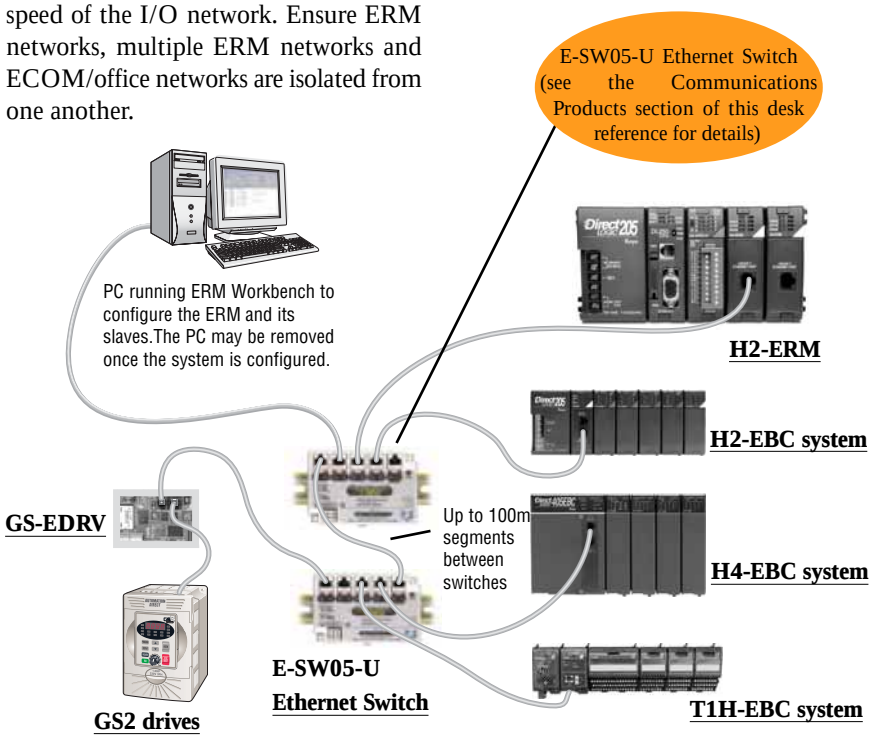
Software configuration

ERM Workbench is a software utility that must be used to configure the ERM and its remote Ethernet slaves. ERM workbench supports two methods of configuring the ERM I/O network:

- ERM Workbench PLC Wizard greatly simplifies the configuration procedure when a PLC is used as the CPU interface.
- ERM Workbench configures the I/O network whether the CPU interface is a PLC or WinPLC, and allows access to all ERM I/O network parameters.

ERM Workbench Software




E-SW05-U Ethernet Switch (see the Communications Products section of this desk reference for details)
PC running ERM Workbench to configure the ERM and its slaves.The PC may be removed once the system is configured.
H2-ERM
H2-EBC system
GS-EDRV
Up to 100m segments between switches
H4-EBC system
E-SW05-U Ethernet Switch
T1H-EBC system
GS2 drives

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ETHERNET BASE CONTROLLER MODULES

Ethernet Base Controller Modules (EBC)

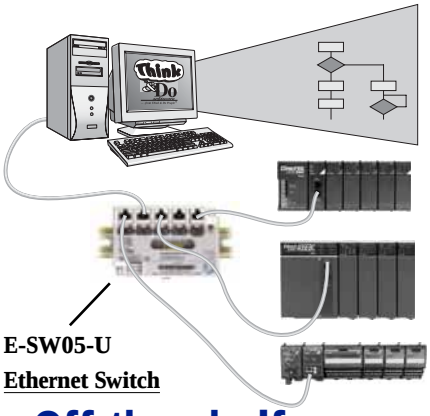
H2-EBC <--->
H2-EBC100 <--->
H2-EBC-F <--->

Specifications	H2-EBC	H2-EBC100	H2-EBC-F
Communications	10BaseT Ethernet	10/100BaseT Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps max.	100Mbps max.	10Mbps max.
Link Distance	100 meters (328 ft)	100 meters (328 ft)	2,000 meters (6,560 ft)
Ethernet Port / Protocols	RJ45, TCP/IP, IPX	RJ45, TCP/IP, IPX, MODBUS TCP/IP, DHCP, HTML configuration	ST-style fiber optic , TCP/IP, IPX
Serial Port / Protocols	RJ12, K-Sequence, ASCII IN/OUT	RJ12, K-Sequence, ASCII IN/OUT MODBUS RTU	None
Power Consumption	450mA	300mA	640mA
Manufacturer	Host Automation Products, L.L.C.		

Use EBCs for PC-based control and for H*-ERM remote I/O slaves

The H2-EBC(100) and H2-EBC-F Ethernet Base Controller modules provide a low-cost, high-performance Ethernet link between DL205 I/O and your PC-based control system or WinPLC/DL205/DL405 CPUs using the H*-ERM module for remote I/O. The H2-EBC100 can also be used to connect your DL205 I/O to a MODBUS TCP/IP client (master). The H2-EBC module supports industry standard 10BaseT Ethernet communications. The H2-EBC100 supports industry standard 10/100BaseT Ethernet communications, and the H2-EBC-F module supports 10BaseFL (fiber optic) Ethernet communications standards. The EBC modules are compatible with TCP/IP, IPX and MODBUS TCP/IP (H2-EBC100 only) protocols for flexible PC communications. EBC modules offer:

- Lower cost on your *Direct*LOGIC I/O system when compared to competitive I/O
- Virtually unlimited number of I/O points
- Deterministic I/O updates on dedicated networks
- Fast I/O updates (<1ms per base)
- On board serial port for possible operator panel, ASCII In/Out, etc. (serial port not supported when used with ERM module)



E-SW05-U
Ethernet Switch

Software developers

For programmers developing custom drivers for our I/O, we offer a free Ethernet Software Development Kit (SDK). The SDK, developed and offered by Host Automation Products, L.L.C., provides a simplified API for interfacing with the H2-EBC(100) or H2-EBC-F. The software interface libraries are provided for WIN32, WIN16, and DOS operating systems. The source code is available to developers under a non-disclosure agreement. Visit the technical support link at our Web site, or go to www.hosteng.com for more information.

Off-the-shelf solutions

You can purchase PC-based control software that is ready to use with the H2-EBC(100) or H2-EBC-F module. PC-based control packages are equipped with compatible I/O device drivers, program development tools, and run-time environments. For a single-source integrated PC-based control solution that ships with everything you need to make your PC into an industrial controller, see the PC-based Control section of this desk reference . Most of the software packages listed below allow you to connect serial devices, such as barcode readers, to the H2-EBC(100)'s serial port.

The chart below identifies vendors that have PC-based Control products ready to control DirectLOGIC I/O, or have products to be released in the immediate future.

```
READ I/O

int HEIReadIO
                (
                HEIDevice *pDevice,
                                Byte *pBuffer,
                                WORD BuffSize
                );

WRITING I/O

int HEIWriteIO
                (
                HEIDevice *pDevice,
                                BYTE *pData,
                                WORD SizeofData,
                                BYTE *pReturnData,
                                WORD
*pSizeofReturnData
                );
```

Easy to use, reliable and fast

The H2-EBC(100) and H2-EBC-F module plugs into the CPU slot of any DL205 I/O base and supports all DL205 discrete and analog I/O modules, the H2-SERIO and H2-CTRIO specialty modules. All EBC modules can be configured using NetEdit3, a free Windows software utility. The H2-EBC100 also supports HTML configuration.

Vendor	Product	Web Address
AutomationDirect	**KEP*Direct* EBC I/O Server**	www.automationdirect.com
Think & Do	Think & Do Live!, Think & Do Studio, Steeplechase	www.Think & Do.com
KEPware	KEPServerEX	www.kepware.com
Wonderware	InControl	www.wonderware.com
MDSI	OpenCNC	www.mdsi2.com

The D2-INST-M installation and I/O Manual covers information about DL205 I/O modules, power budgeting, and installation and wiring. This manual does not cover CPU-slot controllers.

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Ethernet Remote I/O Kits

Ethernet Remote I/O Kits

H2-ERKIT-x

T12-ERKIT-x

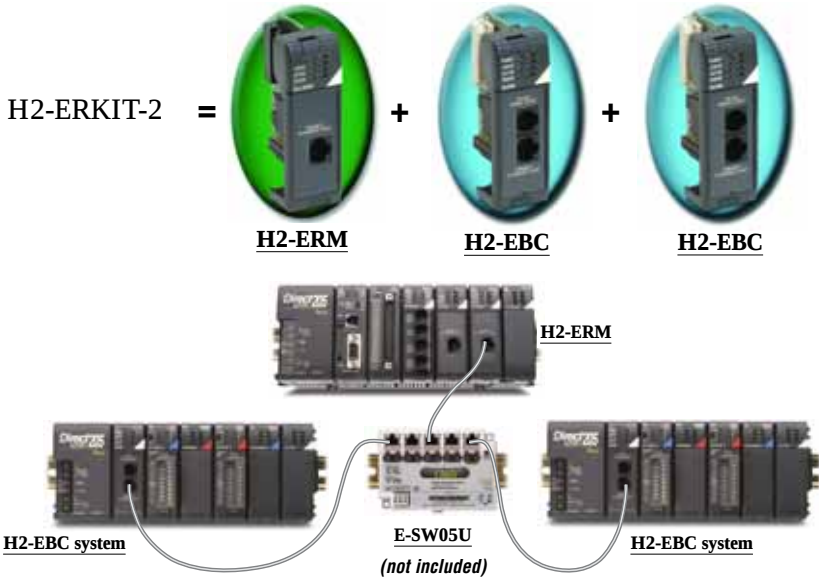
T14-ERKIT-x

Prices start at $369 for a kit with one ERM (Master) and one EBC (Slave). The Ethernet Remote I/O kits are offered in three basic combinations to provide an easy way to choose the Ethernet Remote I/O products that best fit your application.

H2-ERKIT-x Ethernet Remote I/O Kits

An H2-ERKIT-x Ethernet Remote I/O Kit includes one H2-ERM Ethernet Remote Master module and up to "x" number of H2-EBC Ethernet Base Controller modules by adding -1, -2, -3, etc. as the part number suffix. (See the table below.) An H2-ERKIT-2 is shown below, which includes one H2-ERM and two H2-EBC modules. All other necessary hardware, including the CPU, I/O modules, bases, cables and Ethernet hub (if required), is sold separately.

Example kit shown : H2-ERKIT-2 includes one H2-ERM and two H2-EBCs.



Example of an Ethernet remote I/O system using an H2-ERKIT-2. CPU, bases, I/O modules, Ethernet hub, etc. are sold separately.

H2-ERKIT-x Ethernet Remote I/O Kits		
Kit Number	***Kit Contents***	***Price***
H2-ERKIT-1	1 H2-ERM + 1 H2-EBC	<--->
H2-ERKIT-2	1 H2-ERM + 2 H2-EBCs	<--->
H2-ERKIT-3	1 H2-ERM + 3 H2-EBCs	<--->
H2-ERKIT-4	1 H2-ERM + 4 H2-EBCs	<--->
H2-ERKIT-5	1 H2-ERM + 5 H2-EBCs	<--->
H2-ERKIT-6	1 H2-ERM + 6 H2-EBCs	<--->
H2-ERKIT-7	1 H2-ERM + 7 H2-EBCs	<--->
H2-ERKIT-8	1 H2-ERM + 8 H2-EBCs	<--->
H2-ERKIT-9	1 H2-ERM + 9 H2-EBCs	<--->
H2-ERKIT-10	1 H2-ERM + 10 H2-EBCs	<--->

Overview

The DL205 and DL405 PLC Ethernet Remote I/O system is available at prices that are better than many serial remote I/O combinations. This means you can make the switch from Serial PLC Remote I/O to Ethernet Remote I/O and gain all the ease-of-use, diagnostics, and performance of Ethernet connectivity, for little or no additional installation cost.

Additionally, the new Ethernet Remote I/O kits are offered at a considerable savings when compared to purchasing the Ethernet Remote Master (ERM) and Slaves (EBC) separately.

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ETHERNET REMOTE I/O KITS

T12-ERKIT-x Ethernet Remote I/O Kits

A T12-ERKIT-x Ethernet Remote I/O Kit includes one H2-ERM Ethernet Remote Master module and up to "x" number of T1H-EBC Ethernet Base Controller modules by adding -1, -2, -3, etc. as the part number suffix. (See the table to the right.) A T12-ERKIT-2 is shown below, which includes one H2-ERM and two T1H-EBC modules. All other necessary hardware, including the CPU, I/O modules, bases, cables and Ethernet hub (if required), is sold separately.

T12-ERKIT-x Ethernet Remote I/O Kits		
Kit Number	*Kit Contents*	*Price*
T12-ERKIT-1	1 H2-ERM + 1 T1H-EBC	<--->
T12-ERKIT-2	1 H2-ERM + 2 T1H-EBCs	<--->
T12-ERKIT-3	1 H2-ERM + 3 T1H-EBCs	<--->
T12-ERKIT-4	1 H2-ERM + 4 T1H-EBCs	<--->
T12-ERKIT-5	1 H2-ERM + 5 T1H-EBCs	<--->
T12-ERKIT-6	1 H2-ERM + 6 T1H-EBCs	<--->
T12-ERKIT-7	1 H2-ERM + 7 T1H-EBCs	<--->
T12-ERKIT-8	1 H2-ERM + 8 T1H-EBCs	<--->
T12-ERKIT-9	1 H2-ERM + 9 T1H-EBCs	<--->
T12-ERKIT-10	1 H2-ERM + 10 T1H-EBCs	<--->

Example kit: T12-ERKIT-2 includes one H2-ERM and two T1H-EBCs.

T12-ERKIT-2 = + +

H2-ERM T1H-EBC T1H-EBC

Example of an Ethernet remote I/O system using a T12-ERKIT-2. CPU, bases, I/O modules, Ethernet hub, etc. are sold separately.

T14-ERKIT-x Ethernet Remote I/O Kits

A T14-ERKIT-x Ethernet Remote I/O Kit includes one H4-ERM Ethernet Remote Master module and up to "x" number of T1H-EBC Ethernet Base Controller modules by adding -1, -2, -3, etc. as the part number suffix. (See the table to the right.) A T14-ERKIT-2 is shown below, which includes one H4-ERM and two T1H-EBC modules. All other necessary hardware, including the CPU, I/O modules, bases, cables and Ethernet hub (if required), is sold separately.

T14-ERKIT-x Ethernet Remote I/O Kits		
Kit Number	*Kit Contents*	*Price*
T14-ERKIT-1	1 H4-ERM + 1 T1H-EBC	<--->
T14-ERKIT-2	1 H4-ERM + 2 T1H-EBCs	<--->
T14-ERKIT-3	1 H4-ERM + 3 T1H-EBCs	<--->
T14-ERKIT-4	1 H4-ERM + 4 T1H-EBCs	<--->
T14-ERKIT-5	1 H4-ERM + 5 T1H-EBCs	<--->
T14-ERKIT-6	1 H4-ERM + 6 T1H-EBCs	<--->
T14-ERKIT-7	1 H4-ERM + 7 T1H-EBCs	<--->
T14-ERKIT-8	1 H4-ERM + 8 T1H-EBCs	<--->
T14-ERKIT-9	1 H4-ERM + 9 T1H-EBCs	<--->
T14-ERKIT-10	1 H4-ERM + 10 T1H-EBCs	<--->

Example kit: T14-ERKIT-2 includes one H4-ERM and two T1H-EBCs.

T14-ERKIT-2 = + +

H4-ERM T1H-EBC T1H-EBC

Example of an Ethernet remote I/O system using a T14-ERKIT-2. CPU, bases, I/O modules, Ethernet hub, etc. are sold separately.

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Serial Remote I/O Master/Slave Modules

Remote I/O Master Module
D2-RMSM <--->

Remote I/O Slave Module
D2-RSSS <--->

Overview

You can use remote I/O in addition to the I/O in the local base. The remote master is located in the CPU base and communicates with the remote slaves via shielded twisted-pair cable. To use a remote I/O system, you will need the following:

Remote master

One master can be used for each channel. It can be a D2-RMSM, or the bottom port on a D2-250-1 or D2-260 CPU. (The CPU port only supports RM-NET.)

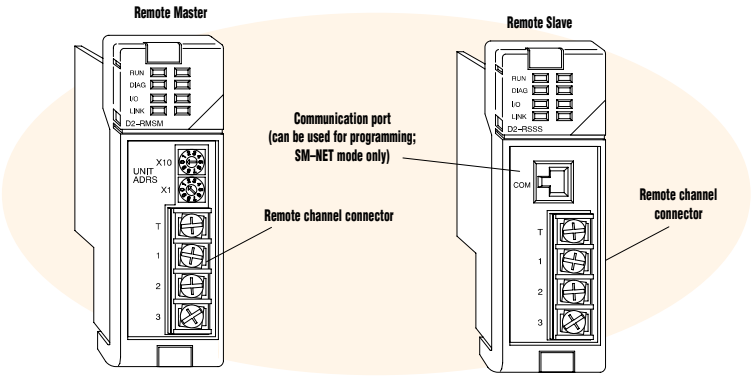
Remote slave

A D2-RSSS and I/O base must be used for each slave.

The remote I/O points are updated asynchronously to the CPU scan. For this reason, remote I/O applications should be limited to those that do not require the I/O points to be updated on every scan.

Remote Master Specifications		
Module Type	Intelligent device	
Number of Masters per CPU	Two maximum for D2-240 and eight (seven + one CPU port) for the D2-250(-1) and D2-260 (built-in master feature in D2-250(-1) and D2-260 bottom port can be used as a master for RM-NET and would count as one master if used). D2-230 does not support remote I/O.	
Maximum Number of Channels	CPU dependent as above	
	Channels may be split between RM-NET and SM-NET if necessary.	
Channel Capacity:	***RM-NET***	***SM-NET***
Maximum # Slaves	7	31
Baud Rates	19.2K, 38.4K baud	Selectable (19.2K, 38.4K, 153.6K, 307.2, 614.4K baud)
Transmission Distance	3,900 ft. (1.2Km)	3,900 feet (1.2Km) @ 19.2 K or 38.4K baud
		1,968 feet (600m) @ 153.6K baud
		984 feet (300m) @ 307.2K baud
		328 feet (100m) @ 614.4K baud
Communication to Slaves	RS485 via twisted pair with shield @ 38.4K baud	
Recommended Cable	Belden 9841 or equivalent - 120 ohm impedance, 12pF/ft	
Terminal Type	Fixed	
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)	
Internal Power Consumption	200mA maximum	
Manufacturer	Koyo Electronics	

Remote Slave Specifications	
Maximum Slave Points per CPU	No remote I/O for D2-230 D2-240, D2-250(-1), D2-260 support a maximum of 2048 points per channel. However, actual I/O available is limited by available I/O points and number of local I/O being used. The D2-240 has a total of 320 X input, 320 Y outputs, and 256 control relays available to share between local and remote I/O. The D2-250(-1) has a total of 512 X inputs, 512 Y outputs and 1024 control relays to share between local and remote I/O. The D2-260 has 1024 X inputs, 1024 Y outputs, 2048 control relays, 2048 GX inputs and 2048 GY outputs to share between local and remote I/O points.
I/O Addresses Used	I/O modules in slave bases do not automatically consume any standard input and output points. You select which points are consumed by setup instructions in your RLL program.
Terminal Type	Fixed
Communications Port	RS232C, 9,600 Baud (same as top port on CPUs, SM-NET mode only)
Base Power Requirement	200mA maximum
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Koyo Electronics



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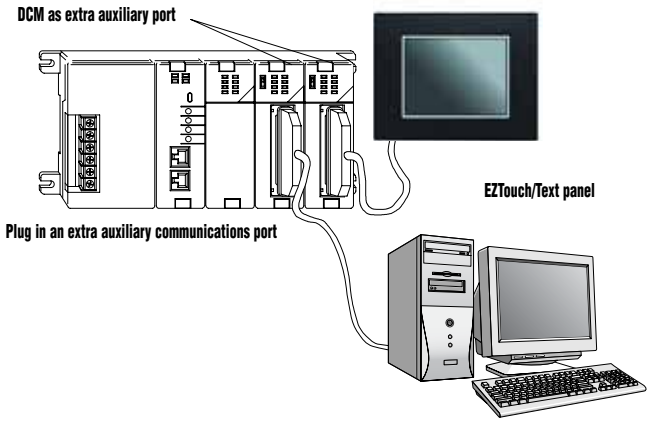
SERIAL DATA COMMUNICATIONS MODULE

Data Communications Module
D2-DCM <--->

The D2-DCM Data Communications Module is used primarily for three reasons:

- Extra communications port to connect a PC, operator interface, etc.
- Network interface to *Direct*NET
- Network interface to a MODBUS® network using the RTU protocol

Specifications	
Module Type	Intelligent
Modules per CPU	7 maximum, slot 1 or higher
CPUs Supported	D2-240 (firmware V1.8 or later), D2-250-1 and D2-260
Communications	RS232C/422 signal levels, *Direct*NET Master/Slave, K-sequence or MODBUS RTU Slave protocol, Baud rate selectable from 300 to 38.4K baud, Odd or No parity, *Direct*NET HEX or ASCII mode
Recommended Cable	Belden 9729 or equivalent (for RS422)
Field Wiring Connector	25-pin D-shell connector
Internal Power Consumption	300mA maximum at 5VDC, (supplied by base power supply)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Koyo Electronics



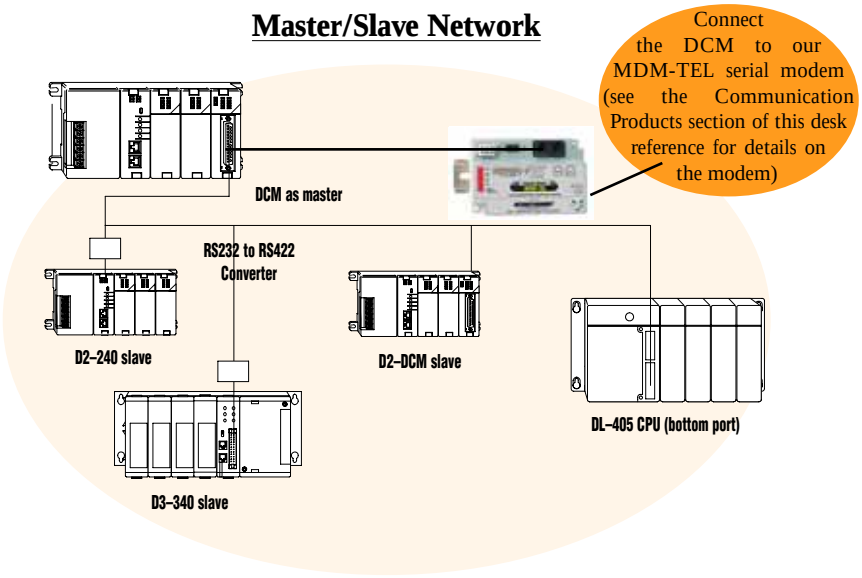
Extra communications port

If additional communication ports are needed, they can easily be added by installing DCM modules. This allows additional connections of devices, such as operator interfaces, PCs, etc. Since the DCM does not require any programming, you can set the DCM communication parameters, connect the cables, and start transferring data. Make sure the device has a DL205 compatible driver.

*Direct*NET network interface

The DCM can be used as a network interface for applications requiring data to be shared between PLCs, or between PLCs and an intelligent device such as a host PC. The DCM connects easily to *Direct*NET. This network allows you to upload or download virtually any type of system data including Timer/Counter data, I/O information, and V-memory information from any *Direct*LOGIC or compatible PLC. The DCM allows the DL205 to function as a network master or network slave.

Master/Slave Network


Connect the DCM to our MDM-TEL serial modem (see the Communication Products section of this desk reference for details on the modem)
DCM as master
RS232 to RS422 Converter
D2-240 slave
D2-DCM slave
DL-405 CPU (bottom port)
D3-340 slave

MODBUS RTU interface

The DCM can be used as a slave station interface to connect your DL205 system to a MODBUS® network using the MODBUS RTU protocol. The host system must be capable of issuing the MODBUS commands to read or write the appropriate data. Remember that the bottom port on the D2-250-1 and D2-260 CPUs can act as a MODBUS master.

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Serial Module for WinPLC and EBC Systems

Serial Communications Module for WinPLCs & EBCs

H2-SERIO <--->

H2-SERIO Specifications	
Module Type	Intelligent module for use with H2–WPLC*-** or PC/EBC system
# of Serial Ports per Module	3
# of modules supported per WinPLC	3
# of modules supported per EBC node	3
Protocols Supported	Serial ASCII and Modbus RTU slave
Connector	RJ12 jack
Power Consumption	210mA @ 5VDC
Operating Environment	0 to 60°C (32°F to 140°F), 5% to 95% RH (non-condensing)
Manufacturer	Host Automation Products, L.L.C.

Serial I/O module for WinPLCs

Add serial ports to your WinPLC system by simply plugging the H2-SERIO modules into the DL205 I/O base. This serial module is used exclusively with the WinPLC. The WinPLC communicates with the H2–SERIO module across the DL205 backplane.

Up to ten serial ports on a WinPLC system

The WinPLC has one built-in serial port. You can add as many as nine additional serial ports for Think & Do Studio or Think & Do Live! applications requiring multiple serial devices, such as barcode scanners. Connect to just about any serial device that communicates ASCII protocol. The H2-SERIO can also serve as a Modbus RTU slave.

Processing large amounts of serial data with a WinPLC

While the H2-SERIO module will support virtually any serial device, processing large amounts of serial data will increase the system response time. This is important to consider when using multiple H2-SERIO modules, especially in a WinPLC local base with an H2-ERM or H2-CTRIO.

Separate communications parameters for each port

Use Think & Do software packages to set baud rate, parity, data bits, and stop bits for each serial port. Choose from 300 to 57,600 baud communication speeds. Think & Do Studio or Think & Do Live! allows each port to be designated as a MODBUS slave or a generic serial device. Each port on the H2–SERIO module is capable of full hardware handshaking.

Easy serial communications

All Think & Do PC control software products include advanced string and array functions that make transmitting, receiving and manipulating serial data a snap.

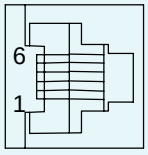
Using H2-SERIO in a PC-based control EBC system

Think & Do Studio version 6.5 supports the use of up to three H2-SERIO modules per EBC node in a PC-based control system. The master must be a PC running Studio 6.5 or later. This does not apply to a WinPLC system with an ERM module used for remote I/O.

The Think & Do features listed on this page for the WinPLC (receiving and manipulating data) also apply to a PC running the Think & Do software.

Pin Assignments for H2-SERIO ports

1	*0V*	*Power (-) Connection (GND)*
2	*CTS*	*Clear to Send*
3	*RXD*	*Receive Data (RS232C)*
4	*TXD*	*Transmit Data (RS232C)*
5	*RTS*	*Request to Send*
6	*0V*	*Signal Ground (GND)*



RJ12 (6P6C) Female Modular Connector

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ETHERNET COMMUNICATIONS MODULE

Overview

Ethernet Communications Modules offer features such as:

- High-speed peer-to-peer networking of PLCs
- Fast updates with ***Direct***SOFT32 Programming Software
- High-performance access for Human Machine Interface (HMI), ERP, MES or other Windows-based software
- Industry standard MODBUS TCP/IP Client/Server Protocol (H2-ECOM100)
- Free SDK for custom drivers
- Easy setup

The Ethernet Communication (ECOM) Modules represent a price breakthrough for high-speed peer-to-peer networking of PLCs. No longer are you forced to designate a single PLC to be the network master. Any PLC can initiate communications with any other PLC. Link your PLCs with PCs using industry standard MODBUS TCP/IP protocol connected through standard cables, hubs, and repeaters. Or, use our KEP*Direct* I/O Server to link to your favorite HMI/SCADA, data historian, MES or ERP software to *Direct*LOGIC PLCs. Our Lookout*Direct* HMI and our DataWorx data collection software include ECOM drivers. *Direct*SOFT32 Programming Software can be used to monitor or update the program in any *Direct*LOGIC PLC on the network.

Simple connections

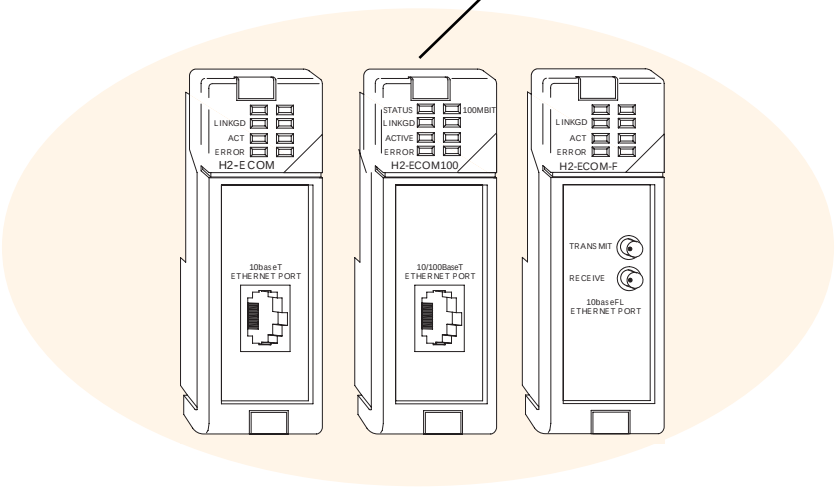
Use Category 5 UTP cables or 62.5/125 ST-style fiber optic cables depending on the requirements of your application. Inexpensive UTP cables can be run up to 100 meters between nodes, and fiber optic cables can be run up to 2,000 meters. Fiber optic cables virtually eliminate electrical noise problems. Use repeaters to extend distances and expand the number of nodes.

Our HA-TADP (10/100BaseT) PC network adapter card is compatible with the ECOM modules. See the Communications Products section in this desk reference for information on the adapter card.

ECOM starter kit

The H2-ECOM-START gives you everything you need to make your first Ethernet network simple to build. It contains an H2-ECOM module and instruction manual, a network adapter card (PCI) for your PC, a crossover cable, and a Software Product Showcase Demo CD. The CD contains demo versions of our software products that support the ECOM Modules. See the Software Products section in this desk reference for information on the available software packages.

The H2-ECOM100 supports the Industry Standard MODBUS TCP/IP Client/Server Protocol



Specifications	H2-ECOM	H2-ECOM100	H2-ECOM-F
Communications	10BaseT Ethernet	10/100BaseT Ethernet	10BaseFL Ethernet
Data Transfer Rate	10Mbps max.	100Mbps max.	10Mbps max.
Link Distance	100 meters (328 ft)	100 meters (328 ft)	2,000 meters (6,560 ft)
Ethernet Port	RJ45	RJ45	ST-style fiber optic
Ethernet Protocols	TCP/IP, IPX	TCP/IP, IPX, MODBUS TCP/IP, DHCP, HTML configuration	TCP/IP, IPX
Power Consumption	450mA @ 5VDC	450mA @ 5VDC	640mA @ 5VDC
Manufacturer	Host Automation Products, L.L.C.		

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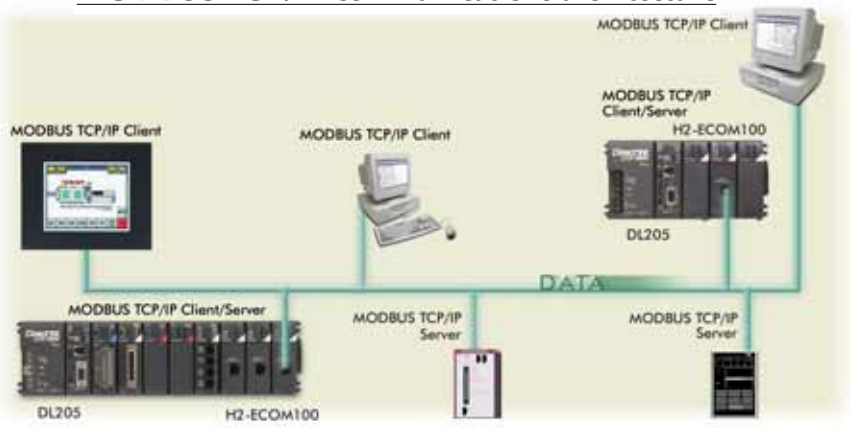
Ethernet Communications Module

MODBUS TCP/IP support

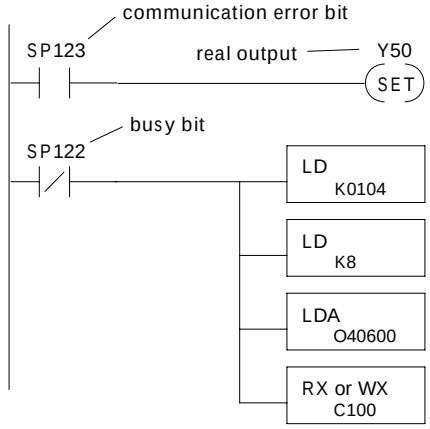
The H2-ECOM100 supports the industry standard MODBUS TCP/IP Client/Server protocol in addition to the standard IP and IPX protocols. This allows the DL205 PLC with an H2-ECOM100 module to serve as a client (master) or as a server (slave) on a MODBUS TCP/IP Ethernet network. The H2-ECOM100 can actively issue MODBUS commands to other nodes or devices on the MODBUS TCP/IP network or simply respond to connected MODBUS TCP/IP clients.

MODBUS TCP/IP communications architecture



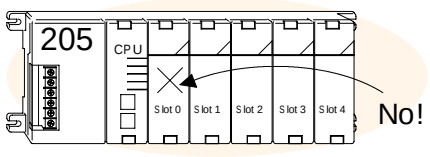
PLC-to-PLC communications

PLC-to-PLC or PLC to a MODBUS TCP/IP device communications are accomplished using Read from Network (RX) and Write to Network (WX) instructions. Build the RX and/or WX instructions into a routine as shown. One SP relay (the busy bit) is used for sequencing of multiple instructions or to prevent a single RX or WX instruction from being overwritten. The other SP relay can be used to annunciate a communication error. The first Load (LD) instruction contains the base and slot number of the initiating ECOM and the Module ID of the responding ECOM or MODBUS TCP/IP device. The second LD instruction contains the number of bytes being transferred. You can transfer up to 128 bytes with one RX or WX instruction. The Load Address (LDA) instruction contains the beginning address in the initiating PLC's memory, regardless of whether or not it is an RX or WX instruction that is being executed. The RX or WX instruction contains the beginning address in the responding PLC or MODBUS TCP/IP device.



Choose your slot

The ECOM modules plug into any I/O slot (excluding slot 0) of any local DL205 I/O base. The module maintains identification data, descriptive information, and communication parameters for PLC-to-PLC communications in flash memory. Disconnect power before installing or removing any PLC module.



Note: Use D2-240, D2-250, D2-250-1 or D2-260 CPUs with the ECOM modules. The D2-230 CPU and D2-CM bases do not support the ECOM modules.

NetEdit3 software

Free NetEdit3 Software ships with the ECOM User Manual. Use NetEdit3 to set up the ECOM modules for your network. Flexible addressing allows you to use your choice of protocols and identifying methods. Assign each module a number or a name or both. You don't have to use an IP address, but you can if it's necessary for your network. NetEdit3 uses two protocols for PC-to-PLC communications: IPX and TCP/IP. Select the one you want to use, or use them both. The NetEdit3 screen displays all identifiers and troubleshooting information for each module on the network. You can use NetEdit3 to adjust parameters for PLC-to-PLC communications by clicking on Advanced Settings. The network identifiers can also be changed from *Direct*SOFT32 Programming Software.

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PROFIBUS SLAVE BASE CONTROLLER

Specifications	
Module Location	CPU slot of any DL205 base
Module Type	CPU device
Maximum Expansion	126 stations, 32 stations per segment, 9 repeaters in a row
Communications	RS-485 Profibus, Profibus-DP. Baud rate selectable from 9.6Kbaud to 12M baud.
Module Connectors	Profibus 9-pin D-shell, RJ-12 serial (for configuration only*)
Internal Power Consumption	530mA maximum at 5VDC (supplied by base power supply)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Host Automation Products, L.L.C.

**** The serial port is used only for configuration of the H2-PBC firmware.***

Overview

If you are using a Profibus controller network, the DL205 I/O sub-system can help reduce the cost of your overall application. The H2-PBC module allows the micro-modular DL205 I/O sub-system to be linked with a Profibus master controller. Profibus is a control bus that provides a common method to connect automation equipment with devices on a single network and significantly reduces hardwiring costs. Profibus provides specifications for information exchanged between nodes, such as controller data associated with low level device and configuration parameters that are individually related to system operations.

How it works

The H2-PBC module is a Profibus slave, which can be plugged into the CPU slot of the DL205 micro-modular family of I/O bases. The module reports all identification data, diagnostic information, and parameters that control the module operation. The H2-PBC module scans and reports all discrete and analog I/O data to a Profibus Master. The AC externally-powered DL205 I/O base units contain a 24 VDC, 0.3A power supply for simple wiring of sensors and actuators into the DL205 I/O modules, and for controlling them with a Profibus Master. Using our Profibus I/O sub-system will increase installation flexibility and save on wiring costs. The H2-PBC module supports all DL205 discrete and analog I/O modules and the H2-CTRIO module.

The Profibus Slave Base Controller also offers the following:

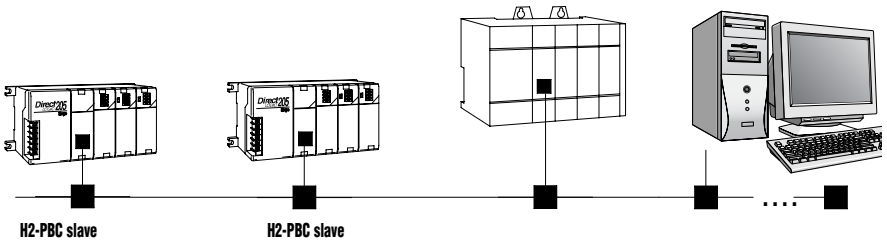
- Cost-effectiveness: Hardwiring cost is reduced with a single network for devices.
- Easy connectivity: Low-cost installation is easy to implement and maintain.
- Diagnostics: Advanced error diagnostics not commonly available in traditional systems are supported.
- High baud rates: Baud rates bring response time down to 10ms per device.
- LED indicators: Provide quick indication of DL205 power and operating mode.

Please Note:

1. The Profibus Slave Base Controller module H2-PBC is a PTO-certified Profibus-compliant slave I/O interface product. See www.profibus.com for more information.

2 For use with Think & Do Software, we recommend the SST Profibus PCI Master Card, part number 5136-PFB-PCI. (AutomationDirect does not provide this interface). See www.mysst.com for more information.

Connect our micro-modular DL205 I/O...



...with your PLC or PC-based Profibus Master.

The D2-INST-M Installation and PLC I/O User Manual covers information about DL205 I/O modules, power budgeting, and installation and wiring. This manual does not cover CPU-slot controllers.

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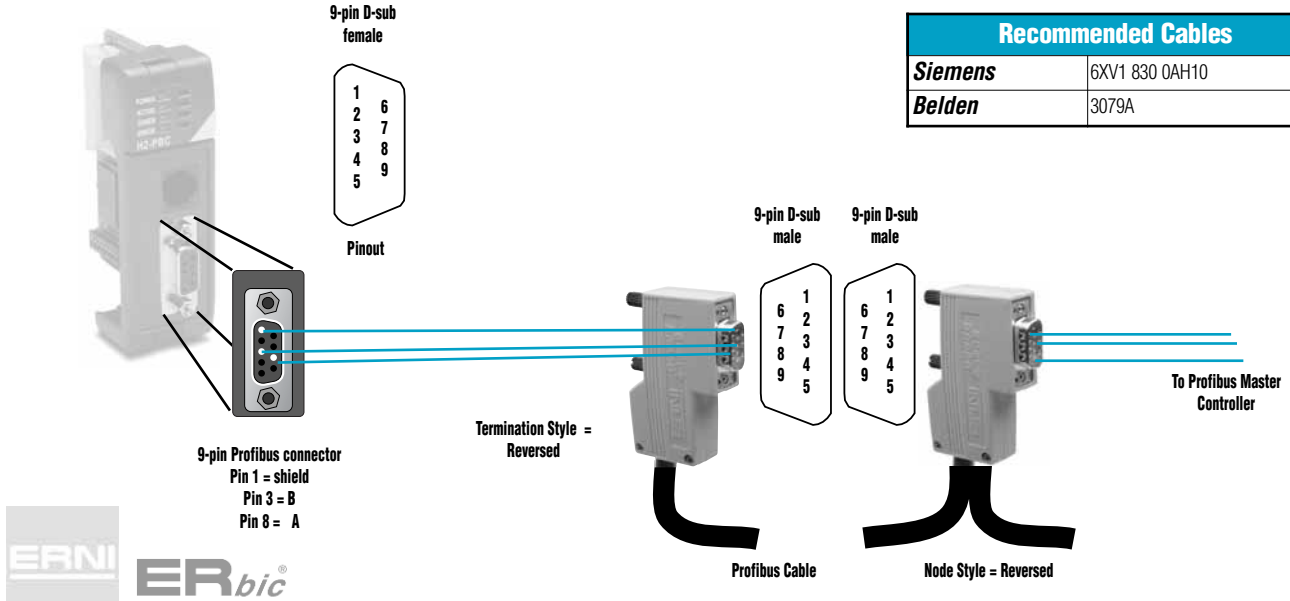
PROFIBUS SLAVE BASE CONTROLLER

Baud	Max. Segment Length		Max. Expansion	
	Feet	*Meters*	*Feet*	*Meters*
9.6Kbps	3278ft.	1000m	32786ft	10000m
19.2Kbps	3278ft.	1000m	32786ft	10000m
93.75Kbps	3278ft.	1000m	32786ft	10000m
187.5Kbps	3278ft.	1000m	32786ft	10000m
500Kbps	1311ft.	400m	13114ft	4000m
1.5Mbps	655ft.	200m	6557ft	2000m
3Mbps	327ft.	100m	3270ft	1000m
6Mbps	327ft.	100m	3270ft	1000m
12Mbps	327ft.	100m	3270ft	1000m

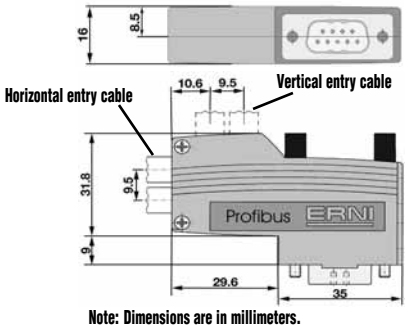
DL205 Style of I/O Modules Supported	
Discrete Types	*Analog Types*
4-point Input	4-channel Input
8-point Input	8-channel Input
16-point Input	2-channel Output
32-point Input	8-channel Output
4-point Output	4-channel In/ 2-channel Output
8-point Output	4-channel Thermocouple
16-point Output (includes 12 pt)	4-channel RTD
32-point Output	
4-point Input/4 point Output	

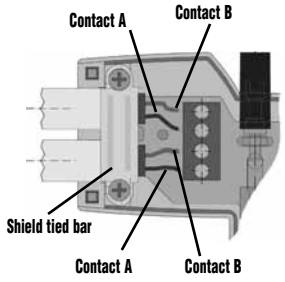
Recommended Cables	
Siemens	6XV1 830 0AH10
Belden	3079A


9-pin D-sub female
1 2 3 4 5 6 7 8 9
Pinout
9-pin Profibus connector
Pin 1 = shield
Pin 3 = B
Pin 8 = A
Termination Style = Reversed
9-pin D-sub male
9-pin D-sub male
6 7 8 9 1 2 3 4 5
6 7 8 9 1 2 3 4 5
To Profibus Master Controller
Profibus Cable
Node Style = Reversed

ERNI ER*bic* connectors for Profibus networks

ERNI ER*bic* connectors are available for the Profibus Base Controller. They are available in node and termination reversed styles for DL205 and PC connections, horizontal or vertical cable entry, and termination or daisy-chain configurations.





ERNI ER*bic* connectors		
Part No.	*Description*	*Device*
104577	Profibus-certified reverse node horizontal connector. 9-pin Male D-Sub	H2-PBC or any Profibus ISA/PCI Personal Computer Master/Slave Card
104322	Profibus-certified reversed termination horizontal connector. 9-pin Male D-Sub	H2-PBC or any Profibus ISA/PCI Personal Computer Master/Slave Card

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DeviceNet Slave Module

Overview

If you are using a DeviceNet controller network, the DL205 I/O sub-system will help reduce the cost of your overall application. The F2-DEVNETS-1 (slave) module allows the popular micro-modular DL205 I/O sub-system to be linked with a DeviceNet master controller. DeviceNet is a low-cost control bus that provides a common method to connect automation equipment with devices on a single network. DeviceNet and it significantly reduces hard wiring costs. The DeviceNet standard provides specifications for information exchanged between nodes, such as controller data associated with low level device and configuration parameters individually related to system operations.

How it works

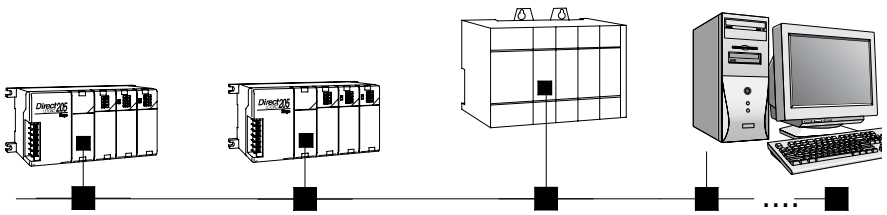
The F2-DEVNETS-1 module is a DeviceNet slave, which can be plugged into the CPU slot of the DL205 micro-modular family of I/O bases. This module maintains a database with all the identification data, diagnostic information, and parameters that control the module operation. The F2-DEVNETS-1 module scans and reports all discrete and analog I/O data to a DeviceNet Master. The AC externally powered DL205 I/O base units contain a 24 VDC, 0.3A power supply for simple wiring of sensors and actuators into the DL205 I/O modules, and for controlling them with a DeviceNet Master. Using our DeviceNet I/O sub-system will increase installation flexibility and save on wiring costs. The F2-DEVNETS-1 module supports all DL205 discrete and analog I/O modules.

The DeviceNet slave module also offers:

- Cost effectiveness: Hardwiring cost is reduced with a single network for devices.
- Easy connectivity: Low-cost four wire installation is easy to implement and maintain.
- Innovative technology: Power is integrated into the device.
- Diagnostics: Advanced error diagnostics not commonly available in traditional systems are available.
- Highly dependable: Fast response and high reliability are featured for demanding applications.
- LED indicators: Provide quick indication of DL205 power and operating mode.

F2-DEVNETS-1 Interface Specifications	
Module Type	CPU device
DeviceNet Compatibility	Predefined Group 2 Master/Slave communications.
Number of I/O	(256 inputs, 256 outputs max.) Defined by number of slots per base. (1024 inputs, 1024 outputs max.) Defined by DeviceNet slave specifications
Module Location	CPU slot of any DL205 base
Maximum Field Devices per bus	64 (see table on next page)
Node Address / CAN Baud Rate	Jumper selectable
Communication to Field Devices	Standard 4-wire shielded cable to cabinet connector, molded 4-wire cable @ up to 500Kbps to field devices
Module Connector	ODVA approved pluggable screw connector
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Internal Power Consumption	160mA @ 5VDC
Manufacturer	FACTS Engineering

Connect our micro-modular DL205 I/O...



...with your PLC or PC-based DeviceNet master.

The D2-INST-M Installation and PLC I/O User Manual covers information about DL205 I/O modules, power budgeting, and installation and wiring. This manual does not cover CPU-slot controllers.

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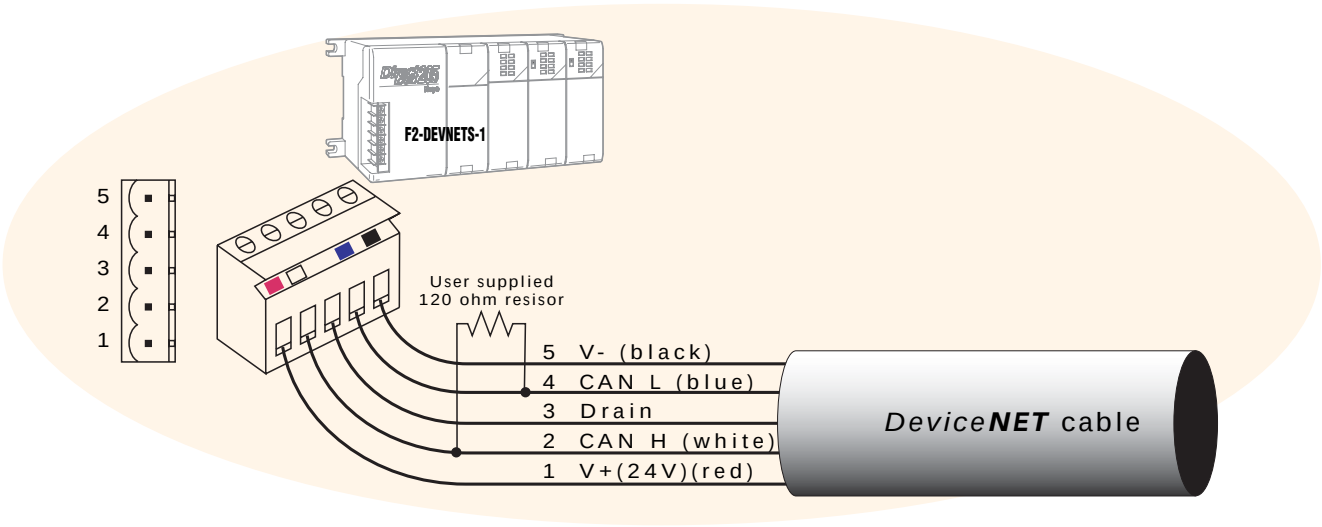
DeviceNet Slave Module

I/O base and network considerations

All discrete and analog I/O modules are supported by the F2-DEVNETS-1 slave module. Choose your DL205 base(s) and I/O modules using the the information in this section.

DL205 Style of I/O Modules Supported	
Discrete Types	***Analog Types***
4-point Input	4-channel Input
8-point Input	8-channel Input
16-point Input	2-channel Output
32-point Input	8-channel Output
4-point Output	4-channel In/ 2 channel Output
8-point Output	4-channel thermocouple
16-point Output (includes 12 pt)	4-channel RTD
32-point Output	
4-point Input/4 point Output	



F2-DEVNETS-1 new features

The F2-DEVNETS-1 module replaces the F2-DEVNETS module and adds the following enhancements:

- DIP Switch selectable node address and CAN baud rate
- ODVA approved pluggable screw connectors
- 1024 inputs and 1024 outputs as defined by DeviceNet Slave specifications (256 physical inputs and 256 physical outputs defined by the number of slots per I/O base)

The F2-DEVNETS-1 can be used as a direct replacement for the previous F2-DEVNETS through a simple jumper selection procedure.

Trunk Length		Bits/sec	Branch Length		Devices
Feet	***Meters***		***Feet***	***Meters***	
328ft	100m	500Kbps	20	6m	64
820ft	250m	250Kbps	20	6m	64
1,640ft	500m	125Kbps	20	6m	64

For other DeviceNet specifications, compatible products and latest DeviceNet information, contact:
Open DeviceNet Vendor Association
Contact: Executive Director Katherine Voss
Phone: 734/975-8840 • Fax: 734/922-0027
Internet address: http://www.odva.org
e-mail: odva@odva.org
ODVA, Inc. • 1099 Highland Drive, Suite A, Ann Arbor, MI. 48108

Please Note:

1. ***The DeviceNet Slave module F2-DEVNETS-1 is an ODVA certified DeviceNet-compliant slave I/O interface product. See www.odva.com for more information.***
2. ***For use with Think & Do Software, we recommend the SST DeviceNet PCI Master Card, part number 5136-DNP-PCI. (AutomationDirect does not provide this interface). See www.mysst.com for more information.***

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SMART DISTRIBUTED SYSTEM (SDS) I/O

Smart Distributed System Module

F2-SDS-1 <--->

Overview

If you are already using or planning to implement an SDS™ controller network, using the F2-SDS-1 module and I/O sub-system can help reduce the cost of your overall application. The Smart Distributed System™ (SDS) provides a means to connect automation equipment and devices on a single network, which eliminates expensive hardwiring. This standard communication media and software provides a low-cost method for controllers and devices to communicate low-level data at high speeds. The SDS standard provides specifications for information exchange between nodes, as well as device-level diagnostics not normally found in other I/O systems. The F2-SDS-1 module allows the well-proven micro-modular DL205 I/O system to be controlled by your SDS master controller.

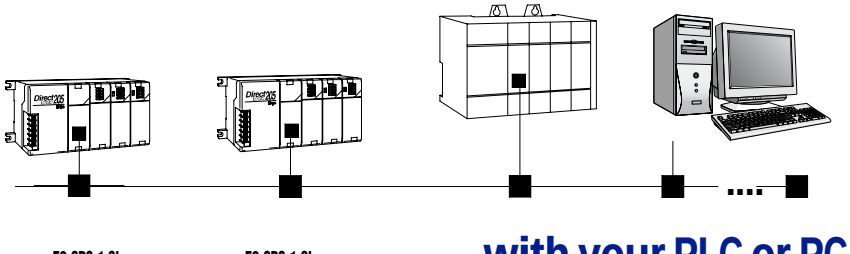
How it works

The F2-SDS-1 module plugs into the CPU slot of any DL205 I/O base. The module maintains a database with all identification data, diagnostic information, and parameters that are configured within the base and control the operation of the SDS slave module and the I/O. The F2-SDS-1 slave will monitor and report discrete and analog I/O module data to an SDS Master. All AC externally powered DL205 I/O base units contain a 24VDC, 0.3A power supply for simple wiring of sensors and actuators into the DL205 I/O modules, and for controlling them with an SDS Master. The F2-SDS-1 module supports all DL205 discrete and analog I/O modules. The SDS also offers:

- Cost effectiveness: SDS offers inexpensive controller and industrial DL205 I/O sub-system.
- Easy connectivity: SDS is a low-cost wiring system that's easy to implement and maintain.
- Innovative technology: Power is integrated into the device.
- Diagnostics: SDS offers advanced error diagnostics not commonly found in traditional systems.
- High baud rates: Baud rate brings response time down to 0.10ms per device.
- LED indicators: Provides indication of DL205 Smart Distributed System.

F2-SDS-1 Interface Specifications	
Module Type	CPU device
Module Location	CPU slot of any DL205 base
Number of I/O	Defined by number of slots per base
Maximum Field Devices per Bus	126 (see table next page)
Max SDS Addresses per CPU	8 discrete, 64 analog
Communication to Field Devices	Standard 4-wire shielded cable to cabinet connector, molded 4-wire cable @ up to 1Mbps to field devices.
Module Connector	5-position removable terminal (European style)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Internal Power Consumption	160mA @ 5VDC
Manufacturer	FACTS Engineering

Connect our micro-modular DL205 I/O...



...with your PLC or PC-based SDS master.

Ask for our D2-INST-M Installation and I/O Manual for complete information about DL205 I/O modules, power budgeting, and installation and wiring. This manual does not cover CPU-slot controllers.

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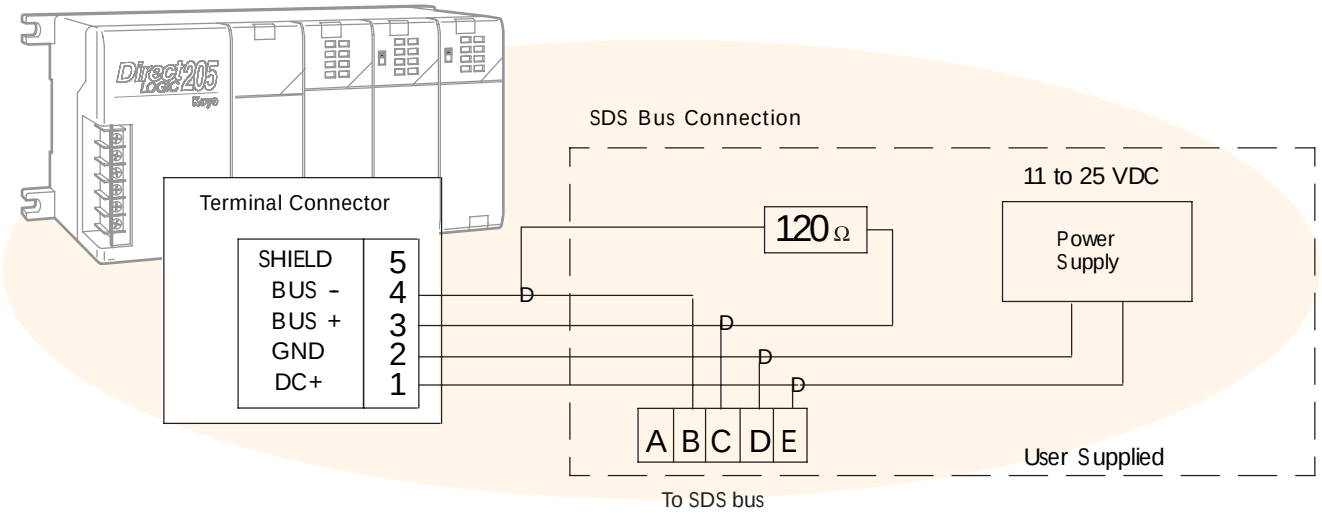
SDS I/O

I/O base and network considerations

All discrete (except 32-pt.) and analog I/O modules are supported by the F2-SDS-1 slave module. Specialty modules are not supported by the F2-SDS-1 module.

DL205 Style of I/O Modules Supported	
Discrete Types	***Analog Types***
4-point Input	4-channel Input
8-point Input	8-channel Input
16-point Input	2-channel Output
4-point Output	4-channel In/ 2 channel Output
8-point Output	4-channel Temperature
16-point Output (includes 12 pt)	
4-point Input/4 point Output	



Trunk Length		Bits/sec	Branch Length		Devices
Feet	***Meters***		***Feet***	***Meters***	
75ft	22.8m	1Mbps	1	0.3m	64
300ft	91.4m	500Kbps	3	0.9m	126
600ft	182.8m	250Kbps	6	1.8m	126
1,500ft	457.2m	125Kbps	12	3.6m	126

Other SDS specifications, compatible products, and latest SDS literature information are made available through:

Honeywell MICRO SWITCH Division
Internet: http://www.honeywell.com
e-mail:info@micro.honeywell.com

Comments to:
SDS Council, IL50/B4-523
Honeywell Micro Switch Division
11 West Spring Street
Freeport, IL 61032

Phone: (800)537-6945 • Fax: (815) 235-5623

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CoProcessor Module

Triple-port BASIC CoProcessor

F2-CP128 <--->

Overview

The BASIC CoProcessor Module interfaces the DL205 family of programmable controllers with bar code readers, operator interface terminals, instrumentation equipment, computers and other serial devices.

BASIC CoProcessor™ applications

BASIC CoProcessors are designed for use with intelligent devices such as:

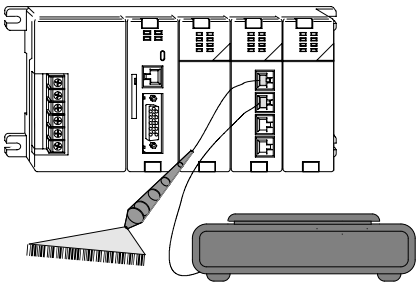
- Bar code readers
- Welders
- Board level controllers
- Serial printers
- Intelligent sensors
- Almost any device with an RS232C/RS422/RS485 port

They are also good solutions for applications requiring complex math: such as, floating point math, sine, cosine, tangent, exponential, square roots, etc.

Features

- FACTS Extended BASIC and ABM Commander for Windows software for IBM PCs makes program development fast and simple. Allows online, full-screen BASIC program editing and the ability to upload / download programs on disk. The CD-ROM includes MODBUS master and slave BASIC programs and other application examples.
- Non-volatile memory of up to 128K allows multiple program storage and execution, DL205 register expansion, and retentive data storage and retrieval.
- 26MHz BASIC CoProcessor provides fast program execution independent of the CPU scan.
- Three buffered ports permit communication from the module to three external devices.
- The module is programmable from port 1 or 2 for complete serial port utilization without switching cables.
- A real-time clock/calendar maintains time/date with battery backup when power outages occur. Programmable time based BASIC interrupts to 0.010 of a second.
- Direct access of up to 254 bytes of DL205 CPU memory per scan is possible. No supporting ladder logic is required.
- Floating point math solves complex formulas to eight significant digits.

Example Application



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BASIC CoPROCESSOR

Triple Port BASIC CoProcessor Module Specification	
Module Type	CoProcessor™, Intelligent
Modules per CPU	Seven maximum, any slot in CPU base (except slot zero)
Communication	256 character type-ahead input buffer on all ports. Ports are independently programmed by software. Seven or eight data bits, one or two stop bits, even, odd, or no parity. XON/XOFF software flow control and RTS/CTS handshake.
F2-CP128	128K bytes of battery-backed RAM. 26MHz clock rate Port 1: RS232C/422/485, 115.2K baud maximum Port 2: RS232C/422/485, 57.6K baud maximum Port3*: RS232C, 19.2 baud max. ** Port 3 physically located in the same RJ12 jack as Port 1 (RS232). Port 3 uses the RTS/CTS pins on that jack. If you use these lines for other purposes (e.g. hardware handshaking on Port 1), then Port 3 cannot be used.*
ABM Commander for Windows (CD included with module)	Programming /documentation software for IBM PCs comes standard. Key features include: • Shipped with each coprocessor module • Runs under Windows 98/2000 • On-line full-screen BASIC program editing (similar to GW Basic, with industrial application enhancements added for easier programming) • Internal Editor for block copy, block move, search and replace • Text upload and download BASIC programs on disk • Binary upload and download BASIC programs and data on disk • Download control statement allows multiple programs to be downloaded and saved with one download file. • CD includes Modbus master and slave BASIC programs and other application examples
Field Termination	Four RJ12 jacks: Port 1/3 RS232, Port 2 RS232, Port 1 RS422/485, Port 2 RS422/485
Power Consumption	235mA @ 5VDC
Operating Environment	0ºC - 60ºC (32ºF - 140ºF), 5% to 95% humidity (non-condensing)
Manufacturer	FACTS Engineering

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HIGH-SPEED COUNTER I/O MODULE

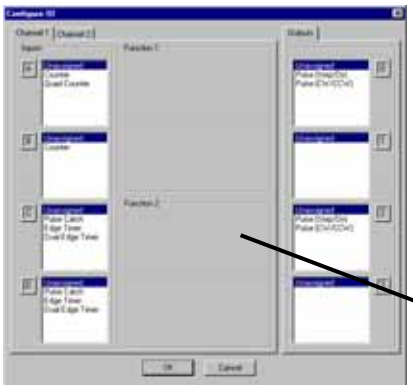
HIgh-Speed Counter I/O Module
H2-CTRIO <--->

Overview

The High-Speed Counter I/O (CTRIO) module is designed to accept high-speed pulse-type input signals for counting or timing applications, and is designed to provide high-speed pulse-type output signals for stepper motor control, monitoring, alarm or other discrete control functions. The CTRIO module offers great flexibility for applications that call for precise counting or timing, based on an input event or for high-speed control output applications.

The CTRIO module has its own microprocessor and operates asynchronously with respect to the PLC/Controller. This means that the on-board outputs respond in real time to incoming signals so there is no delay waiting for the PLC/Controller to scan I/O.

The H2-CTRIO module is designed to work with incremental encoders or other field devices that send pulse outputs.



Use Configure I/O dialog to assign the CTRIO input and output functions

CTRIO features

The CTRIO modules offer the following I/O features:

- 8 DC sink/source inputs, 9-30VDC
- 4 isolated sink/source DC outputs, 5-36 VDC, 1A per point

Inputs supported:

- 2 quadrature encoders counters up to 100kHz, or 4 single channel counters up to 100kHz using module terminals Ch1A, Ch1B, Ch2A and Ch2B
- High-speed edge timers, dual edge timers, pulse catch, count reset, count inhibit or count capture or home search limits using module terminals Ch1C, Ch1D, Ch2C or Ch2D

Outputs supported:

- 4 independently configurable high-speed discrete outputs or 2 channels pulse output control (20Hz-25kHz per channel)
- Pulse and direction or cw/ccw pulses supported for pulse output control
- Raw control of a discrete output directly from user control program

Software Configuration

All scaling and configuration is done via CTRIO Workbench, a Windows software utility program. This eliminates the need for PLC ladder programming or other interface device programming to configure the module. CTRIO Workbench runs under Windows 98/2000/XP and NT 4.0 SP5 or later.

CTRIO Workbench main configuration screen

Typical applications

- High-speed cut-to-length operations using encoder input
- Pick-and-place or indexing functions controlling a stepper drive
- Dynamic registration for web material control
- Accurate frequency counting for speed control with onboard scaling
- PLS (Programmable Limit Switch) functions for high-speed packaging, gluing, or labeling
- Sub 10 µsec pulse-catch capability for high-speed product detection
- Functions for level or flow

Supported systems

Multiple CTRIO modules can reside in the same base provided that the backplane power budget is adequate. Depending which CPU/interface module is used, there may be I/O base slot restrictions for the CTRIO module. Refer to the CTRIO High-Speed Counter Manual (HX-CTRIO-M) for I/O slot restrictions.

*Direct*LOGIC DL205 PLC

You can use the H2-CTRIO module with the D2-240, D2-250(-1) and D2-260 CPUs. (It is not supported in local expansion bases or in D2-RSSS serial remote I/O bases.)

DL205 Win PLC

The H2-CTRIO module can be used in DL205 WinPLC systems (H2-WPLC*-**).

PC-based Ethernet I/O control systems

The H2-CTRIO module can be used in PC-based control systems using the H2-EBC interface module

ERM to EBC systems

The H2-CTRIO module is supported in H2-EBC slaves in H*-ERM systems. This includes the supported DL205 CPUs and WinPLC systems.

Profibus systems

The H2-CTRIO module can be used in Profibus systems using the H2-PBC slave interface module.

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HIGH-SPEED COUNTER

I/O Specifications

General	
Module Type	Intelligent
Modules Per Base	Limited only by power consumption
I/O Points Used	None, I/O map directly in PLC V-memory or PC control access
Field Wiring Connector	Standard removable terminal block
Internal Power Consumption	400mA Max at +5V from Base Power Supply, Maximum of 6 Watts (All I/O in ON State at Max Voltage/Current)
Operating Environment	32°F to 140°F (0°C to 60°C), Humidity (non-condensing) 5% to 95%
Manufacturer	Host Automation Products, L.L.C.
Isolation	2500V I/O to Logic, 1000V among Input Channels and All Outputs

H2-CTRIO Input Specifications	
Inputs	8 pts sink/source 100 kHz max.
Minimum Pulse Width	5 µsec
Input Voltage Range	9-30VDC
Maximum Voltage	30VDC
Input Voltage Protection	Zener Clamped at 33VDC
Rated Input Current	8mA typical 12mA maximum
Minimum ON Voltage	9.0VDC
Maximum OFF Voltage	2.0VDC
Minimum ON Current	5.0mA (9VDC required to guarantee ON state)
Maximum OFF Current	2.0mA
OFF to ON Response	Less than 3 µsec
ON to OFF Response	Less than 3 µsec

H2-CTRIO Output Specifications	
Outputs	4 pts, independently isolated, current sourcing or sinking FET Outputs: open drain and source with floating gate drive
Voltage range	5VDC - 36VDC
Maximum voltage	36VDC
Output clamp voltage	60VDC
Maximum load current	1.0A
Maximum load voltage	36VDC
Maximum leakage current	100µA
Inrush current	5A for 20ms
OFF to ON response	less than 3µsec
ON to OFF response	less than 3µsec
ON state V drop	0.3V max.
External power supply	for loop power only, not required for internal module function*
Overcurrent protection	15A max
Thermal shutdown	Tjunction = 150°C
Overtemperature reset	Tjunction = 130°C
Duty cycle range	1% to 99% in 1% increments (default = 50%)
Configurable Presets a) single b) multiple	a) each output can be assigned one preset, or b) each output can be assigned one table of presets, one table can contain max. 128 presets, max. predefined tables = 255

*** User supplied power source required for stepper drive configuration.**

H2-CTRIO Input Resources	
Counter/Timer	4, (2 per 4 input channel group)
Resource Options	1X, 2X, or 4X Quadrature, Up or Down Counter, Edge Timer, Dual Edge Timer, Input Pulse Catch, Reset, Inhibit, Capture
Timer Range / Resolution	4.2 billion (32 bits); 1 µsec
Counter Range	+ / - 2.1 billion (32 bits or 31 bits + sign bit)

H2-CTRIO Output Resources	
Pulse output / Discrete outputs	Pulse outputs: 2 channels (2 outputs each channel) Discrete outputs: 4 pts.
Resource Options	Pulse outputs: pulse/direction or cw/ccw; Profiles:Trapezoid, S-Curve, Symmetrical S-Curve, Dynamic Position, Dynamic Velocity, Home Search, Velocity Mode, Run to Limit Mode and Run to Position Mode Discrete outputs: 4 configurable for set, reset, pulse on, pulse off, toggle, reset count functions (assigned to respond to Timer/Counter input functions). Raw mode: Direct access to discrete output from user application program
Target Position Range	+ / - 2.1 billion (32 bits or 31 bits + sign bit)

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HIGH-SPEED COUNTER

Status indicators

H2-CTRIO LED Descriptions	
OK	Module OK
ER	User Program Error
1A	Channel 1 Status
2A	Channel 2 Status
0 - 3	Output Status

H2-CTRIO LED Diagnostic Definitions		
LED OK	***LED ER***	***Description***
ON	OFF	All is well - RUN Mode
ON	ON	Hardware Failure
Blinking	Blinking	Boot Mode - Used for Field OS Upgrades
Blinking	OFF	Program Mode
OFF	Blinking	Module Self-diagnostic Failure
OFF	ON	Module Error Due to Watchdog Timeout
OFF	OFF	No Power to Module

H2-CTRIO LED Diagnostic Definition	
1A/2A	
Blinking 7 times per second	Input is configured as Counter and is changing
Following state of input	Input is not configured as counter
0-3	
Follow actual output state: ON = output is passing current	

Installation and wiring

The H2-CTRIO module has two independent input channels, each consisting of 4 optically isolated input points (pts. 1A-1D on common 1M and pts. 2A-2D on common 2M). The inputs can be wired to either sink or source current.

The module has 4 optically isolated output points (pts. Y0-Y3 with isolated commons C0-C3, respectively). The outputs must be wired so positive current flows into Cn terminal and then out of the Yn terminal (see the diagram on the following page).

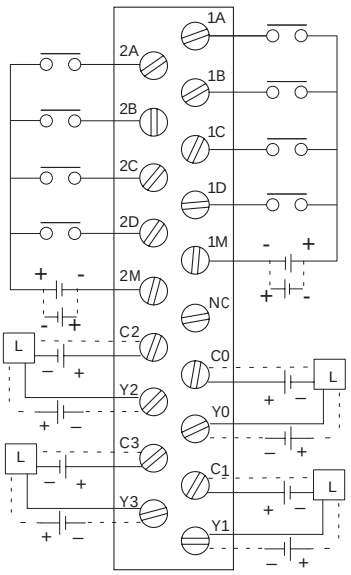
Remember that the internal jumpers can be used to connect the input commons or outputs/output commons together.

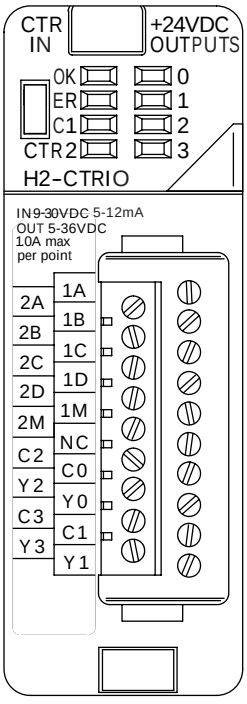
The module is configured, using CTRIO Workbench, to accommodate the user's application. The function of each input (counting, timing, reset, etc.) and output (pulse output, discrete output, etc.) is defined in the configuration of the module.

See the notes below for further details about power source considerations, circuit polarities, and field devices.

Notes:

1. ***Inputs (1A, 1B, 1C, 1D and 2A, 2B, 2C, 2D) require user-provided 9-30VDC power sources. Terminals 1M and 2M are the commons for Channel 1 and Channel 2 inputs. Maximum current consumption is 12mA per input point.***
2. ***Polarity of the input power sources can be reversed. Consideration must be given, however, to the polarity of the field device. Many field devices are designed for only one polarity and can be damaged if power wiring is reversed.***
3. ***Outputs have one polarity only and are powered by user-provided 5-36VDC power sources. The maximum allowable current per output circuit is 1A.***





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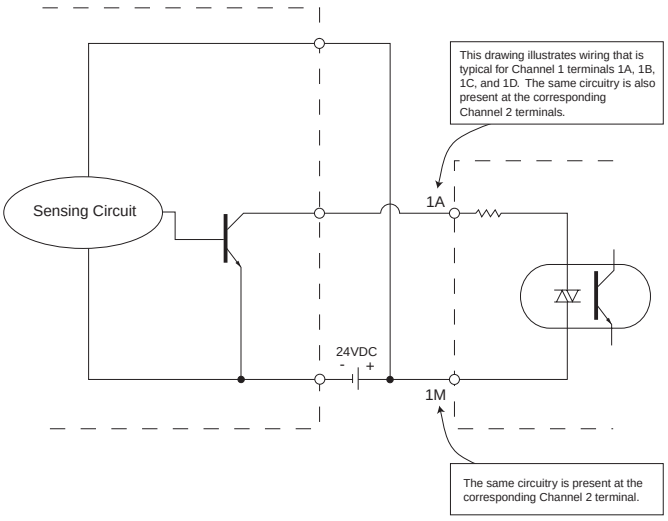
HIGH-SPEED COUNTER

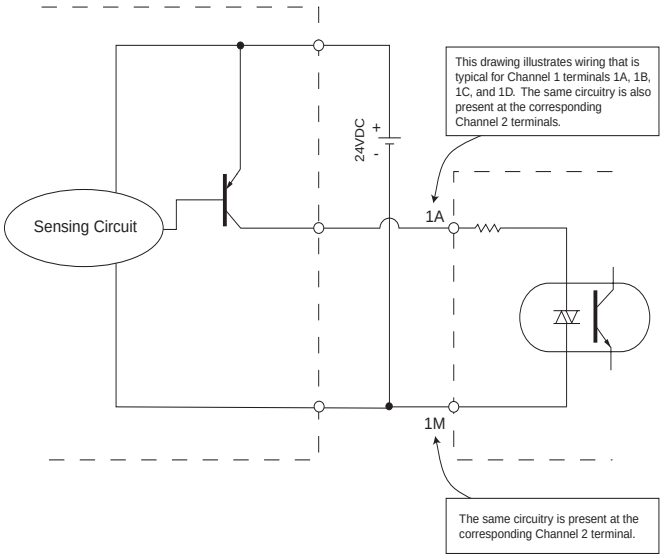
Solid state input wiring device

DC types of field devices are configured to either sink or source current. This affects the wiring of the device to the CTRIO module. Refer to the sinking/sourcing appendix in this desk reference for a complete explanation of sinking and sourcing concepts.

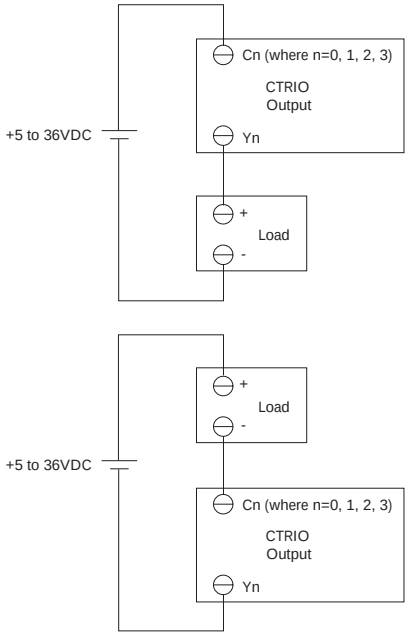
NPN Field Device (sink)


This drawing illustrates wiring that is typical for Channel 1 terminals 1A, 1B, 1C, and 1D. The same circuitry is also present at the corresponding Channel 2 terminals.
Sensing Circuit
1A
24VDC
1M
The same circuitry is present at the corresponding Channel 2 terminal.

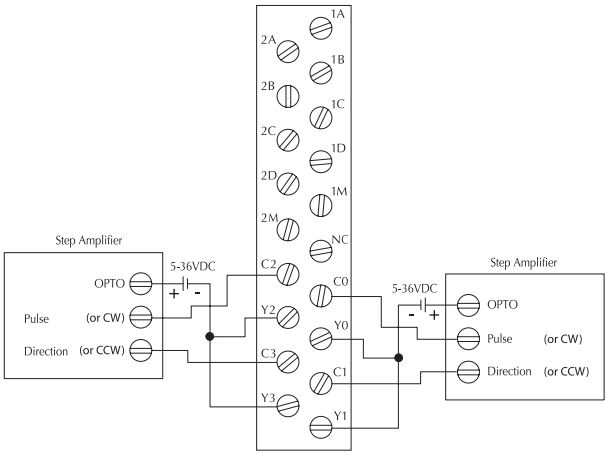
PNP Field Device (source)


This drawing illustrates wiring that is typical for Channel 1 terminals 1A, 1B, 1C, and 1D. The same circuitry is also present at the corresponding Channel 2 terminals.
24VDC
Sensing Circuit
1A
1M
The same circuitry is present at the corresponding Channel 2 terminal.

Pulse output schematic



Stepper/Servo drive wiring example



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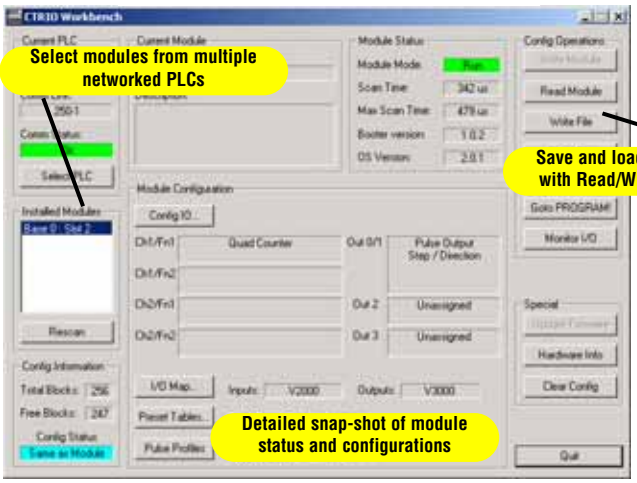
HIGH-SPEED COUNTER

Fill-in-the-blank configuration software

The CTRIO Workbench is the software utility used to configure the CTRIO module and to scale signals to desired engineering units. Workbench also allows you to perform various other functions, such as switching between the CTRIO's Program mode and Run mode, monitoring I/O status and functions, and diagnostic control of module functions. The CTRIO Workbench utility ships with the CTRIO User Manual. You can also download the latest version free at the Host Engineering's Web site: www.hosteng.com.

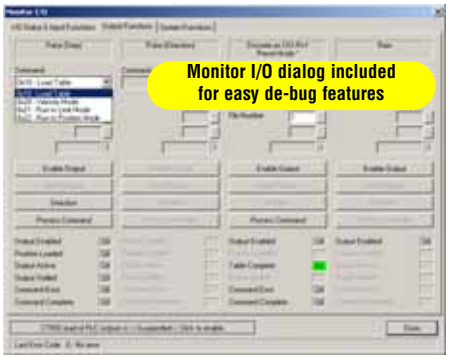
CTRIO Workbench main configuration screen


Select modules from multiple networked PLCs
Save and load configurations with Read/Write File feature
Detailed snap-shot of module status and configurations

CTRIO Workbench diagnostics and monitoring

The Monitor I/O dialog is accessible from the main Workbench dialog when the module is in Run Mode. This allows for a convenient way to test and debug your configuration prior to installation. The Monitor I/O dialog is divided into three functional areas: Input Functions, Output Functions and System Functions. The data displayed under the Input Functions tab includes all input Dword parameters, status bits and the current status of each configured input and output function. The fields displayed under the Output Functions tab includes all output (D)word parameters and configuration information that can be altered during runtime and the bits that indicate successful transfers or errors. The System Functions can be used to read from or write to the CTRIO's internal registers.

Monitor I/O screen

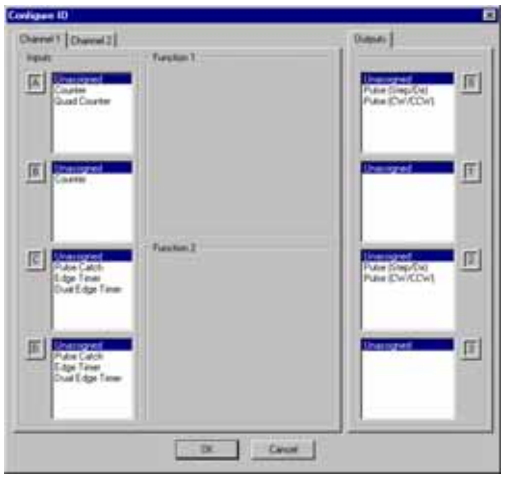


CTRIO Workbench configure I/O setup

The Configure I/O dialog is the location where input and output functions are assigned to the module. The choice of input and output functions determines which options are available. The input function boxes prompt you with selections for supported functions. The Workbench software automatically disallows any unsupported configurations.

H2-CTRIO

Configure I/O screen



CTRIO Workbench on-board scaling

Scaling raw signals to engineering units is accomplished using the Scaling Wizard. The Scaling Wizard options are different for the Counter functions as compared to the Timer functions. "Position" and "Rate" scaling are available when you select a Counter function. "Interval" scaling is available when you select a Timing function.

Scaling Wizard screen

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High-Speed Counter

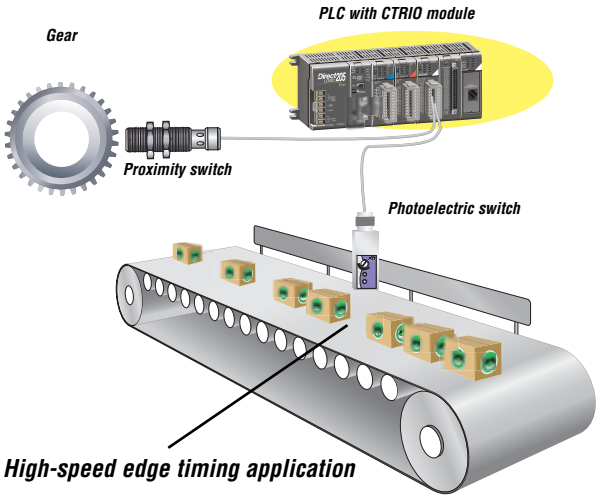
High-speed input operations

The CTRIO module is capable of a wide variety of high-speed input and output operations, all within one module. With its flexible 2-channel input and separate 2-channel output design, the CTRIO can satisfy high-speed counting, timing, and pulse catch operations, along with high-speed discrete output or several profile choices of pulse output operations. Not all combinations of input functions and output functions are possible within the resources of the module, but the following examples are some of the most common applications for the CTRIO. Check out these examples and see how they relate to your high speed application needs.

High-speed timing

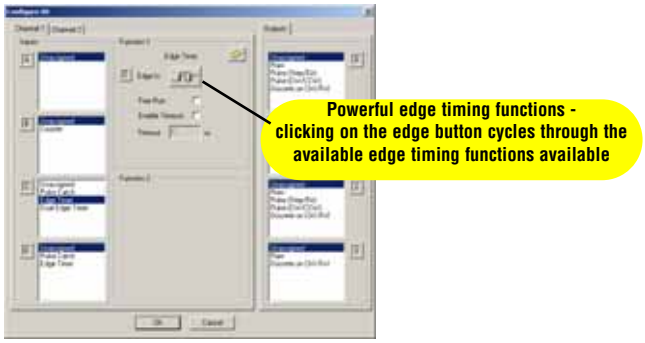
The CTRIO can be configured for timing functions based on both count or rate. Using a common configuration of a proximity switch sensing the teeth on a gear, the module is able to calculate the velocity of the gear based on the rate it receives its counts. This value can be scaled within the module to the engineering units required for the application.

High-speed timing application



High-speed edge timing application

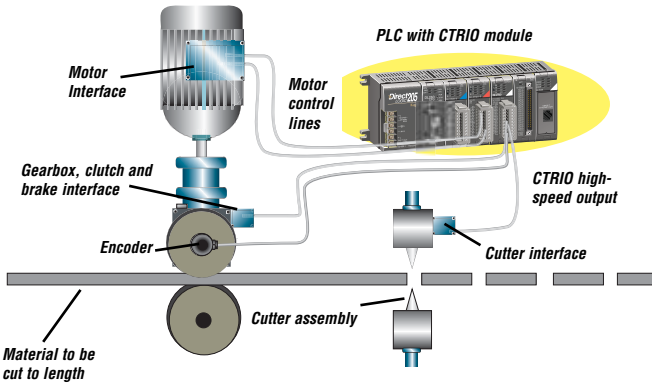
Using Configure I/O screen to configure CTRIO for high-speed timing


Powerful edge timing functions - clicking on the edge button cycles through the available edge timing functions available

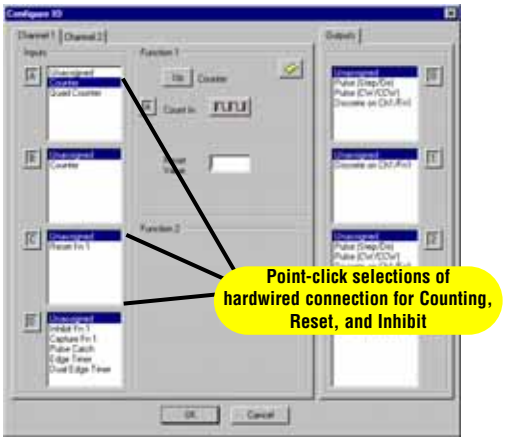
High-speed counting

The CTRIO can be configured for counting functions for the use of an encoder input (up to two quadrature encoders per module), with available connections for external reset, capture and inhibit signals. In a simple cut-to-length application as shown, the encoder provides an input position reference for the material to the module. The module's high-speed outputs are wired to the cutting device and to the clutch and/or braking device. When the count from the encoder is equal to a pre-programmed setpoint within the module, the high-speed outputs are activated to stop and cut the material to a repeatable fixed length. Additionally, the clutch/brake signal can be used as an inhibit signal so counts are not accumulated while the material is being cut.

High-speed cut-to-length application



Using Configure I/O screen to configure CTRIO for high-speed counting



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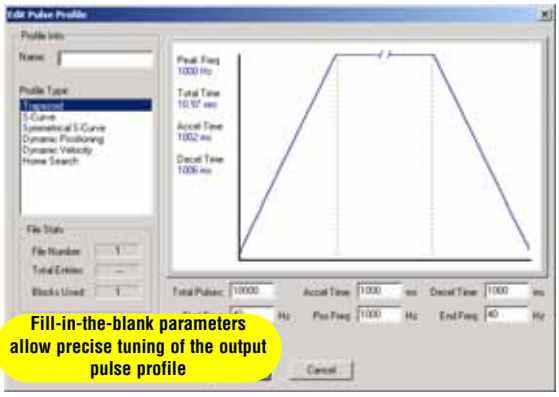
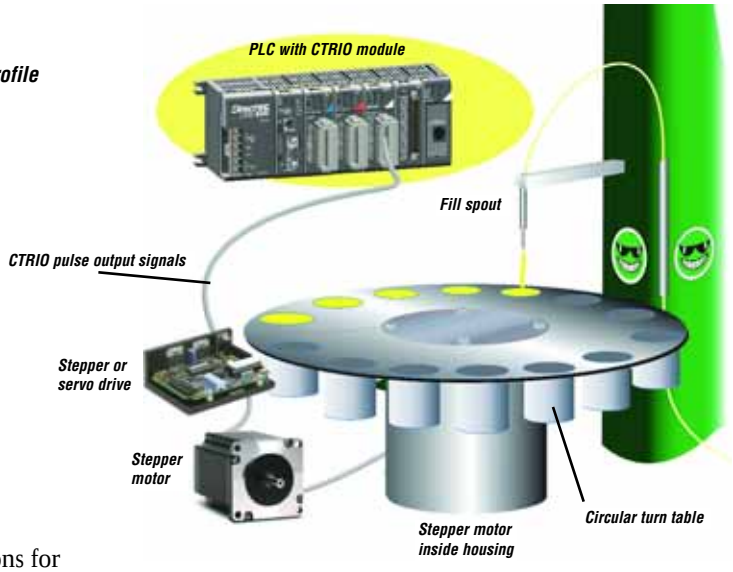
HIGH-SPEED COUNTER

Pulse output operations

Using Edit Pulse Profile screen to select Trapezoid pulse output profile





Rotary indexing liquid fill application

Pulse output for stepper/servo control

The CTRIO module is capable of multiple configurations for pulse output control, most often when connected to a stepper or servo drive system. The module can deliver a pulse output signal up to a maximum of 25kHz on two channels with support for pulse-and-direction or CW/CCW pulses. The available profile choices include Trapezoid, S-Curve, Symmetrical S-Curve, Dynamic Positioning, Dynamic Velocity, and Home Search. All profiles can be easily configured using the CTRIO Workbench software with fill-in-the-blank parameter fields and a graphic representation of the selected profile. Three additional profiles are available that are completely controlled by the user program (no CTRIO profile is configured). They are Velocity Mode, Run to Limit Mode, and Run to Position Mode.

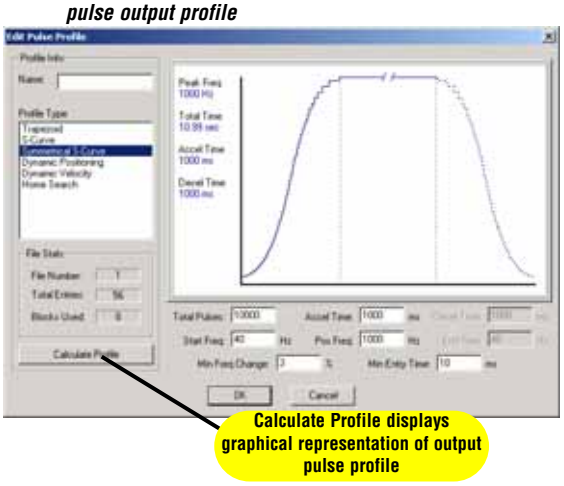
Example application

In a simple rotary indexing application, as shown above, a fixed Trapezoid profile is chosen. The CTRIO for this application is wired to a stepper drive for pulse-and-direction. The requirement for this application is to provide a smooth movement of the rotary table to allow product to be filled into individual containers at an equal distance apart. The predetermined number of pulses required for each movement is entered into the CTRIO Workbench as "Total Pulses" along with the Starting Frequency, Ending Frequency, and Positioning Frequency (speed after acceleration). The Acceleration and Deceleration parameters are entered in units of time, so no ramp-distance calculations are required. After all parameters are entered, a graphical representation of the configured profile is shown automatically. Once the configuration has been downloaded to the module, all that is needed from the PLC CPU is for the Enable Output signal to begin a movement.

Other common pulse output applications:

- S-Curve accel/decel profile for signaling a stepper or servo drive that needs a curved acceleration and deceleration profile, i.e. for diminishing any initial "jerk" upon movement of static products, boxes on conveyors, liquids in containers on an indexer, printing registrations, etc.
- Dynamic Positioning for any run-to-a-specific-position requirement, either by a pre-programmed count of an external high-speed discrete input wired to the module. This is popular in winding or web control with any dynamic registration mark or variable speed requirement.
- Home search routines to seek a home position based on CTRIO discrete input limit(s).

Example of S-Curve acceleration and deceleration pulse output profile



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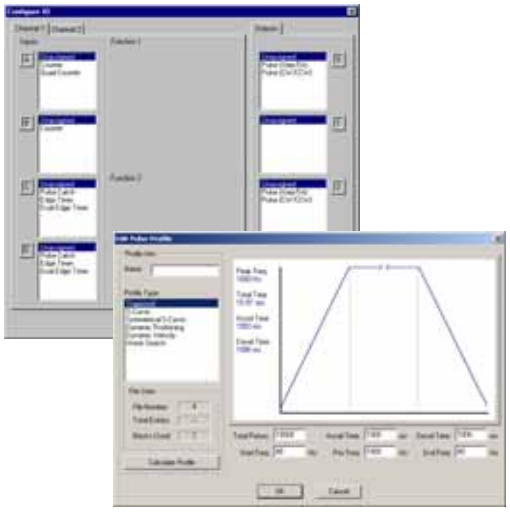
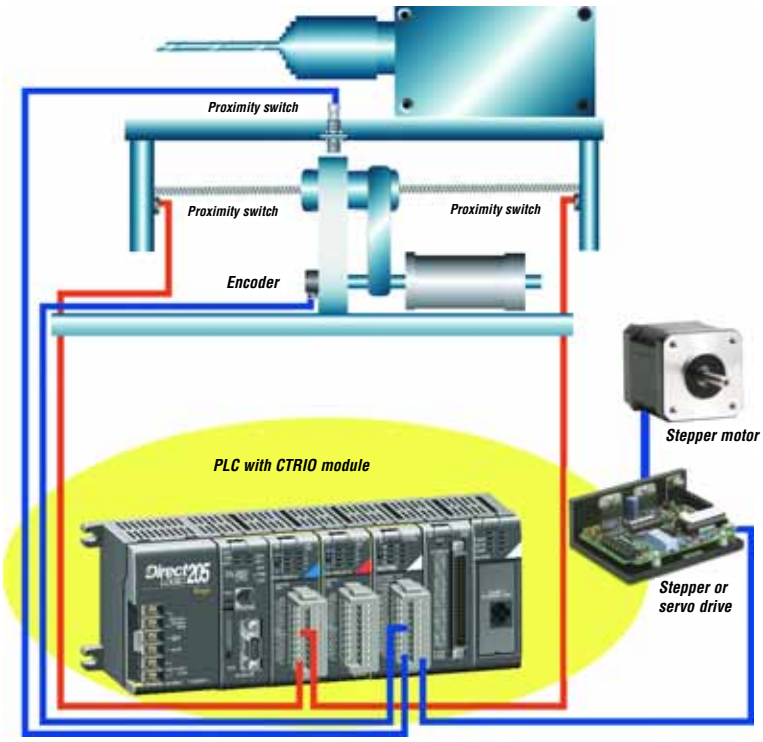
HIGH-SPEED COUNTER

Combining high-speed input and pulse output operations

Using CTRIO Workbench to configure the module for simultaneous high-speed input and high-speed pulse output operation



Multihead drill machine application

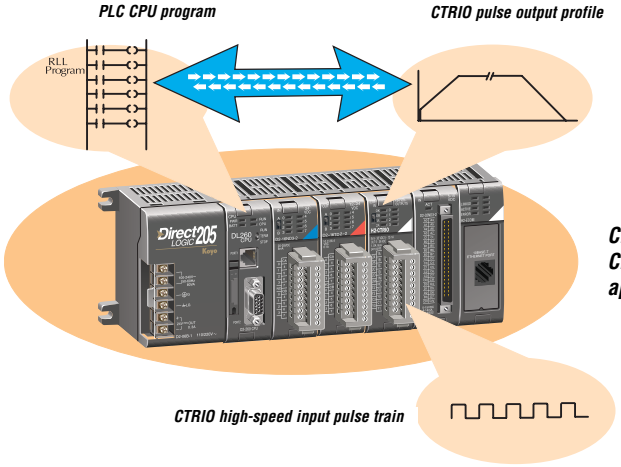


High-Speed inputs and pulse output combinations

The flexible design of the CTRIO module allows for combining high-speed inputs and delivering high-speed pulse outputs signals simultaneously. There are limitations to this type of configuration in that the module does not internally support closed loop control. Providing closed loop control with the CTRIO involves additional PLC code to coordinate this control, making the application subject to the PLC CPU program scan. Simple position/speed monitoring via a high-speed counting input for non-critical response, while providing pulse outputs to a drive, is easily achievable for the CTRIO.

Example application

In the simple drill-head application shown above, the CTRIO pulse outputs are wired to a stepper and/or servo drive. The inputs are wired to an encoder attached to the lead screw on the movable portion of the drill-head assembly. The CTRIO module output pulse train to the drive allows the motor to spin the lead screw, making the drill move forward into the passing material. The encoder monitors the speed and position of the drill-head. Prox switches at each end act as limit switches ensuring the drill-head will not over-travel. A home sensor is positioned in the middle of the assembly which allows the PLC to reset the count.



Closed loop control for the CTRIO module requires PLC CPU program interaction to close the loop. This makes the application subject to the PLC CPU scan.

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COUNTER INTERFACE MODULE

Overview

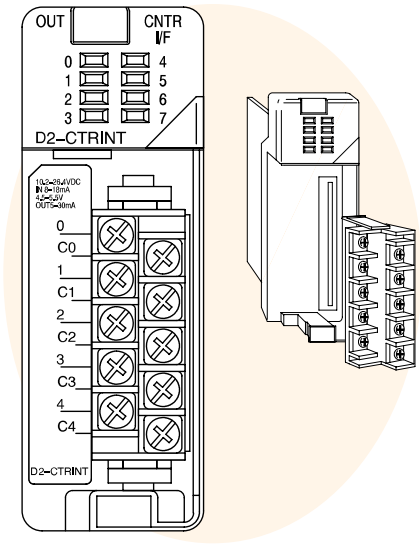
The DL205 CPUs can be configured to work with the D2-CTRINT to provide the following features. (Only one D2-CTRINT can be used in a DL205 base).

- Up to two built-in 5kHz high-speed counters with 24 presets each
  When the preset is reached, an interrupt routine in the CPU is executed. The D2-240, D2-250-1 and D2-260 support 2 channels and the D2-230 supports 1 channel.
- Quadrature encoder input for clockwise and counterclockwise position control (D2-240/250-1/260)
- Programmable pulse output with external interrupts and separate acceleration and deceleration profiles for positioning and velocity control (5K pulses per second max) (D2-240/250-1/260)
- 4 external interrupt inputs for immediate responses to tasks.
- Pulse catch feature allows the CPU to read 4 inputs, each having a pulse width as small as 0.1ms.
- Programmable filters for reading up to 4 input signals to ensure input signal integrity
- Combine features to utilize the full potential of the module. Some modes do not use all available points. So in some cases, you can assign one of the other features to the point(s) not used by the main mode of operation.
- Even though some modes can be used together, you cannot use the module for closed-loop control (i.e., you cannot use pulse output and counter input features together).

Overall module specifications	
Module Type	Discrete
Modules per CPU	One only in slot adjacent to CPU
I/O Points Used	8 inputs, 8 outputs
Field Wiring Connector	Standard 8 pt. removable terminal block
Internal Power Consumption	50mA from 5VDC max., (supplied by the CPU base power supply)
Operating Environment	32°F to 140°F (0°C to 60°C) humidity (non-condensing) 5% to 95%
Manufacturer	Koyo Electronics

Input specifications	
Input	4 pts. sink/source 5 kHz max.
Minimum pulse width	100 µSec
Input voltage range	12 or 24VDC ±15%
Maximum voltage	30VDC
Rated input current	10mA Typical 13mA Maximum
Minimum ON voltage	8.0VDC
Maximum OFF voltage	1.0VDC
Minimum ON Current	8.0mA
Maximum OFF Current	1.0mA
OFF to ON response	Less than 30µS
ON to OFF response	Less than 30µS

Output specifications	
Output	2 pts., current sinking, 5kHz Max
Voltage range	5.0VDC±15%
Maximum voltage	5.5VDC
Maximum load current	30mA
Minimum load voltage	4.5VDC
Leakage current	Less than 0.1mA at 5.5VDC
Inrush current	0.5A (10mS)
OFF to ON response	Less than 30µS
On to OFF response	Less than 30µS
External power supply	5.0VDC±10%



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COUNTER INTERFACE MODE 10

Mode 10: two high-speed up counter inputs

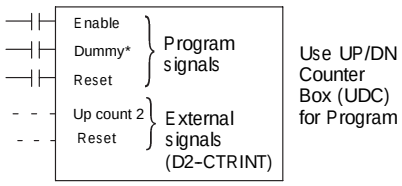
Each DL205 CPU has internal features that support high-speed counting up to 5kHz. (Two counters for the D2-240, D2-250(-1) and D2-260, only one for the D2-230). You connect the external pulse input and reset input signals to the internal counter by using the counter interface module (D2-CTRINT). The embedded counters are independent of the CPU ladder logic execution, so counting is not affected by the scan time. When the counter reaches a preset value (up to 24 presets per counter), the CPU stops executing the main program and executes an interrupt subroutine associated with the UP counter (one interrupt subroutine per UP counter). You can program the subroutine with any of the instructions normally available in subroutines. Also, an internal "Equal" relay assigned to each preset is set ON when the associated preset matches the actual count (24 "Equal" relays per counter). This allows you to easily trigger actions based on the current count. For example, you could use Immediate I/O instructions to provide a fast response. The CPU resumes normal operations from where it left off after the interrupt subroutine is finished.

Turning the Enable input of the counter off and on will halt and resume the counting. Counters can reset by either an external signal (X2, X3) or by special internal relays that can be activated by the program. Presets can be either absolute or incremental. Absolute presets are compared directly to the actual count. Incremental presets compare the actual count to the result of adding the associated preset value to the previous preset value.

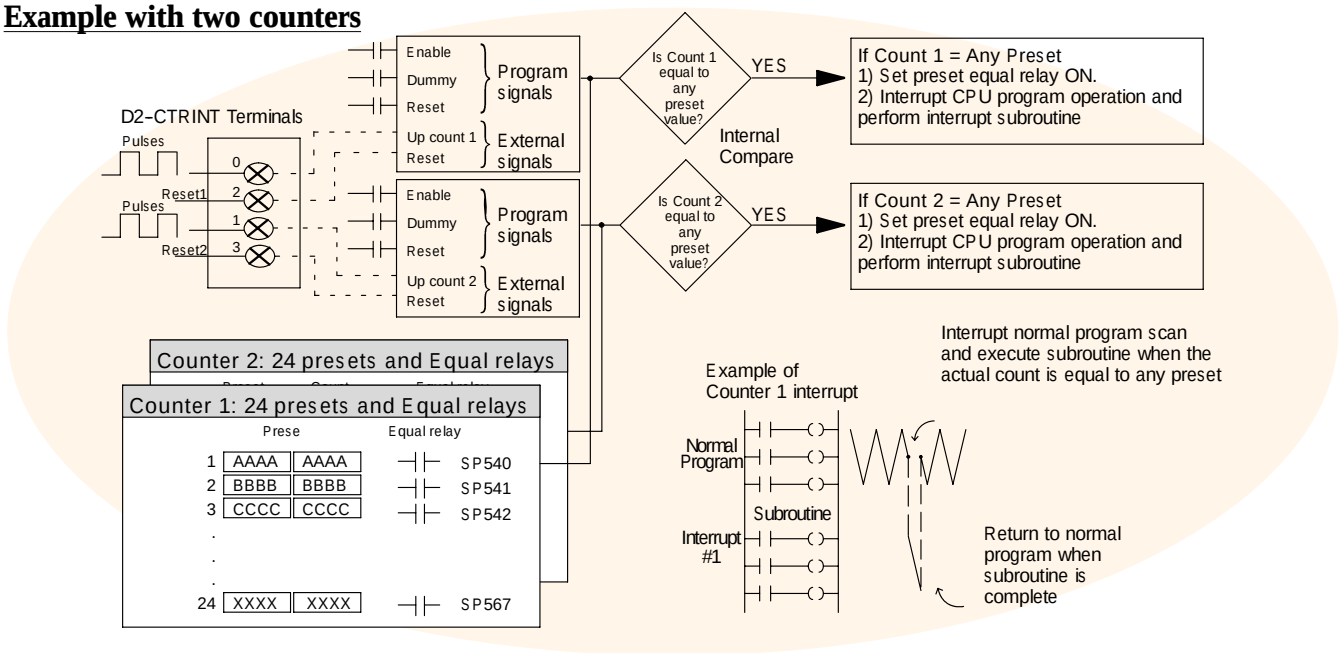
Input Specifications	
Input Voltage	12 or 24VDC
Frequency	5 kHz maximum
Minimum Pulse Width	100µS
Maximum Count	99,999,999
Preset Types	Absolute or Incremental
Number of Presets	24 per counter
Interrupt Priority	Counter 1 over Counter 2

Input Assignments for Up counter	
Input 1	Up count of UP counter 1 (X0)
Input 2	Up count of UP counter 2 (X1)
Input 3	External Counter 1 reset (X2)
Input 4	External Counter 2 reset (X3)

Built-in high-speed counter



Example with two counters


D2-CTRINT Terminals
Pulses
Reset1
Pulses
Reset2
Enable
Dummy
Reset
Program signals
Up count 1
Reset
External signals
Up count 2
Is Count 1 equal to any preset value?
YES
If Count 1 = Any Preset
1) Set preset equal relay ON.
2) Interrupt CPU program operation and perform interrupt subroutine
Internal Compare
Is Count 2 equal to any preset value?
If Count 2 = Any Preset
1) Set preset equal relay ON.
2) Interrupt CPU program operation and perform interrupt subroutine
Interrupt normal program scan and execute subroutine when the actual count is equal to any preset
Counter 2: 24 presets and Equal relays
Counter 1: 24 presets and Equal relays
Prese
Equal relay
1 AAAA AAAA SP540
2 BBBB BBBB SP541
3 CCCC CCCC SP542
24 XXXX XXXX SP567
Example of Counter 1 interrupt
Normal Program
Subroutine
Interrupt #1
Return to normal program when subroutine is complete

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COUNTER INTERFACE MODE 20

Mode 20: one up/down counter (quadrature counter)

By selecting Mode 20, the two high-speed UP counters (5kHz) embedded internally in the D2-240, D2-250(-1) and D2-260 CPUs are configured to operate as a single 5kHz Up/Down counter (not available in D2-230). Two external pulse inputs (count up and count down) and one reset input signal are connected to this internal Up/Down counter by means of the D2-CTRINT counter interface module. In addition, there are two signals used in the control program: a counter enable input, and a counter reset input.

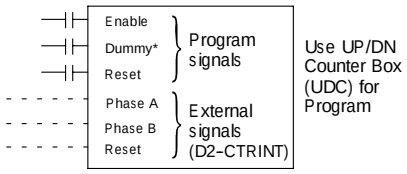
Just like the UP counter, the UP/DOWN counter is also independent of the CPU ladder logic execution, so counting is not affected by the scan time. When the counter reaches a preset value (up to 24 presets), the CPU stops executing the main program and executes an interrupt subroutine that is associated with the counter. You can program the subroutine with any of the instructions that are normally available in subroutines. Also, an internal "Equal" relay assigned to each preset is set ON when the associated preset matches the actual count. This allows you to easily trigger actions based on the current count. For example, you could use Immediate I/O instructions to provide a fast response. The CPU resumes normal operations from where it left off after the interrupt subroutine is finished.

Turning the ENABLE input of the counter off and on will halt and resume the counting. Presets can be either absolute or incremental. Absolute presets are compared directly to the actual count. Incremental presets compare the actual count to the result of adding the associated preset value with the previous preset value.

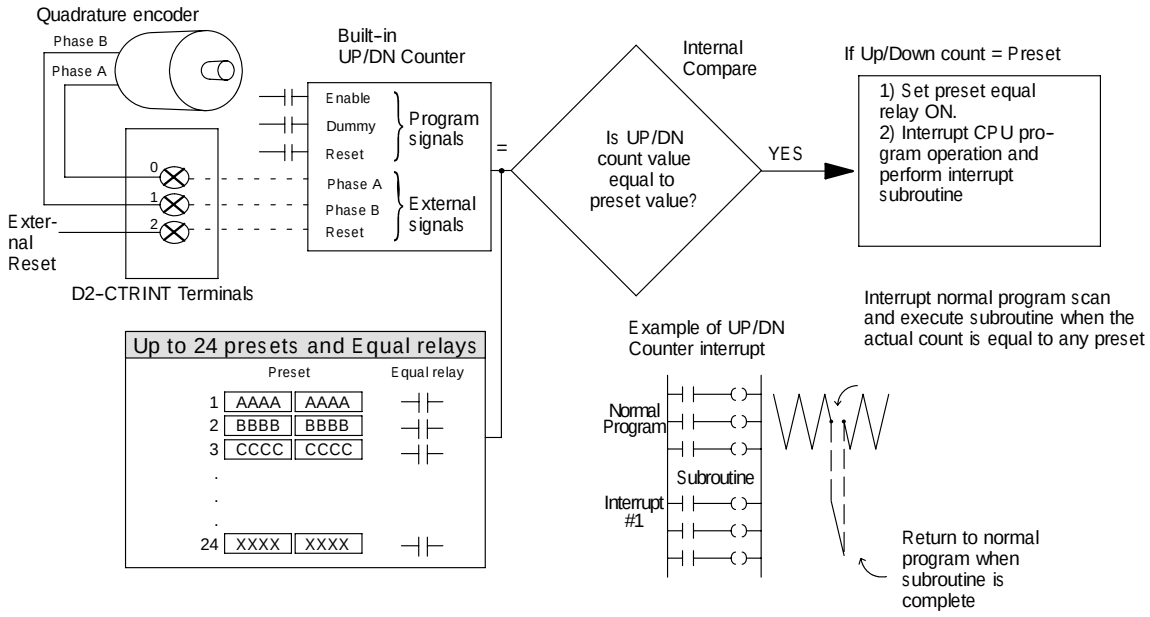
Up/Down Counter Specifications	
Input voltage	12 or 24 VDC
Frequency	5 kHz maximum
Minimum pulse width	100µs
Count Range	-8,388,608 to 8,388,607
Preset Types	Absolute or incremental
Number of presets	24 (Two words per preset)

Input Assignment for the Up/Down Counter	
Input 1	Phase A (X0)
Input 2	Phase B (X1)
Input 3	External counter reset (X2)

Built-in UP/DN counter



Example of Up/Down Counter



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Counter Interface Mode 30

Mode 30: pulse output

By selecting Mode 30, you can use the pulse output feature with a D2-240, D2-250(-1) and D2-260 CPUs to build simple motion and positioning control systems. Transfer and indexing tables are common applications. Choose the profile and motion parameters by using special CPU V-memory locations that are designated for use with the Counter Interface module. The module can be configured for independent CW/CCW pulse train output, or step and direction, regardless of the profile chosen. The pulses are sent out independently of the CPU scan, so scan time does not affect the pulse generation. The pulse output is enabled through ladder logic by activating Y4. LEDs on the front indicate interrupt, clockwise and counterclockwise output status.

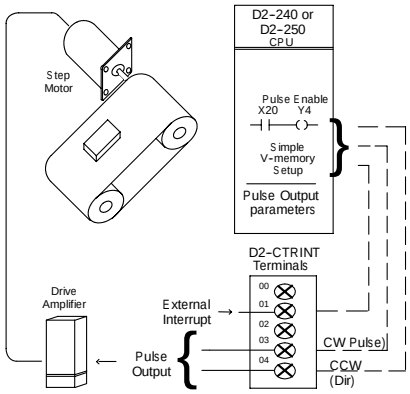
The trapezoid profile is also referred to as the Automatic acceleration/deceleration profile. Specify a target destination (number of pulses), a starting velocity (pulses per second), a positioning velocity, an acceleration time, and a deceleration time. Once you have specified these parameters, the module automatically controls the actual acceleration /deceleration velocity and pulse output. Acceleration/deceleration times can be in the range of 100ms to 10 seconds. This mode also allows you to perform simple registration. By using the external interrupt, you can delay counting toward the target number of pulses until the interrupt occurs.

Complex acceleration/deceleration allows you to specify a target destination, an overall positioning velocity, and up to four steps each of acceleration/deceleration. Each acceleration/deceleration step can be configured individually for a target pulse count and positioning velocity. Also, you do not have to use all four steps. You can choose the number that works best for your particular application.

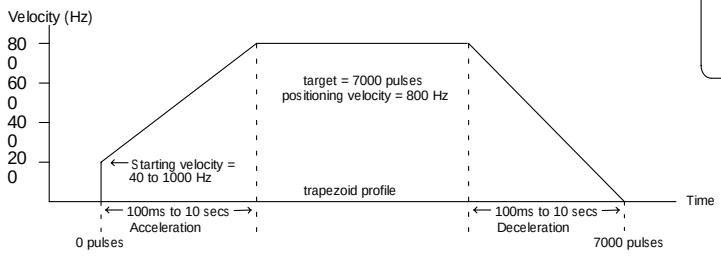
You can also choose a velocity-only mode. In this scenario, you control only the velocity. There is no target destination (number of pulses). Simply change the velocity value as necessary to achieve the desired results.

Pulse Output Specifications	
External Power Supply	5VDC±10%
Output Frequency	5 kHz maximum
Target Pulse Range	-8,388,608 to 8,388,607
Velocity Range	40 to 5000 pulses/sec (in units of 10 pulses)
Pulse Distance	1 to 9999 per step

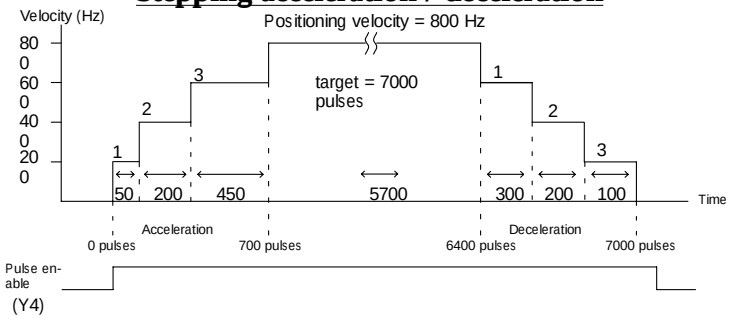
Input Assignments for the Up/Down Counter	
Input 1: (01)	External interrupt
Output 1: (03)	CW pulse output
Output 2: (04)	CCW pulse output



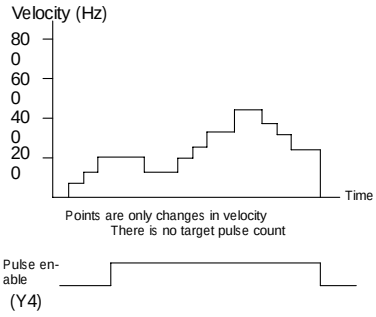
Automated acceleration / deceleration



Stepping acceleration / deceleration



Velocity control



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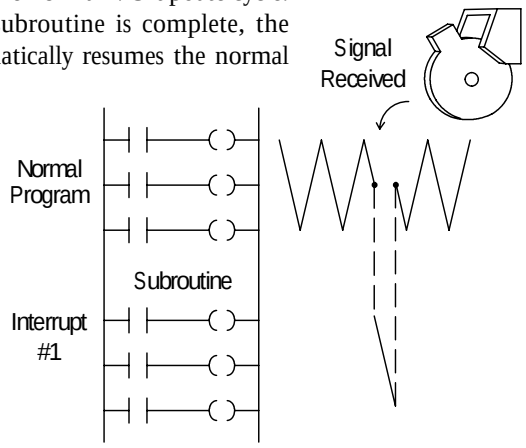
COUNTER INTERFACE MODE 40/50

Mode 40: four external interrupts

By selecting Mode 40, you can use the Counter Interface as a high-speed interrupt input module. The D2-230/240/250(-1)/260 CPUs support this mode.

An interrupt input is especially useful in applications that have a high priority event that requires special operations to be performed. When this high-priority event occurs, the interrupt module senses an ON input signal. The module automatically informs the CPU to interrupt its present operation. The CPU immediately suspends its routine scan cycle execution and jumps to a subroutine identified with that particular interrupt input signal point. You can program the subroutine with any of the instructions that are normally available in subroutines. For example, you could use immediate I/O instructions to immediately read inputs and update outputs without waiting on the normal I/O update cycle. When the subroutine is complete, the CPU automatically resumes the normal scan cycle starting at the exact location from where it was interrupted. The CPU continues the routine scan until another interrupt signal is sensed.

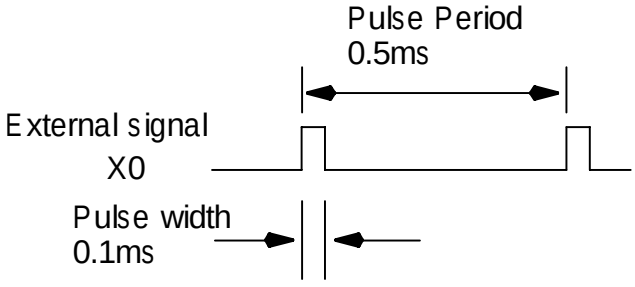
Interrupt Input Specifications	
Point Assignments	Four Interrupts (X0, X1, X2, X3)
Minimum Pulse Width	100µS
Trigger	Leading edge
Interrupt Priority	X0 first, X1 second, X2 third, X3 fourth
Interrupt Subroutines	Four (INT0, INT1, INT2, INT3)

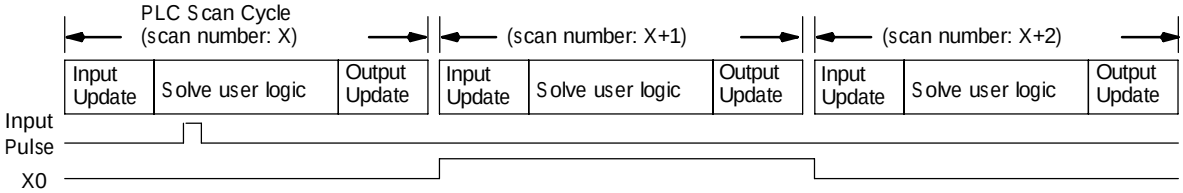


Mode 50: four pulse catch inputs

By selecting Mode 50, the D2-230, D2-240, and D2-250 CPUs can capture very fast (narrow) pulse inputs that cannot typically be detected during the normal input update cycle. Up to four different external inputs (X0, X1, X2, X3), with pulse widths as small as 0.1ms (and a pulse period greater than 0.5ms) can be trapped. When an external pulse is encountered, X0-X3 is set in the ON state for the next scan of the CPU and automatically set to the OFF state. Like the other modes, the pulse catch feature operates independently of the CPU scan.

Pulse Catch Input Specifications	
Point assignments	Four inputs (X0, X1, X2, X3)
Minimum pulse width	0.1ms
Pulse Period	More than 0.5ms
Trigger	Leading edge





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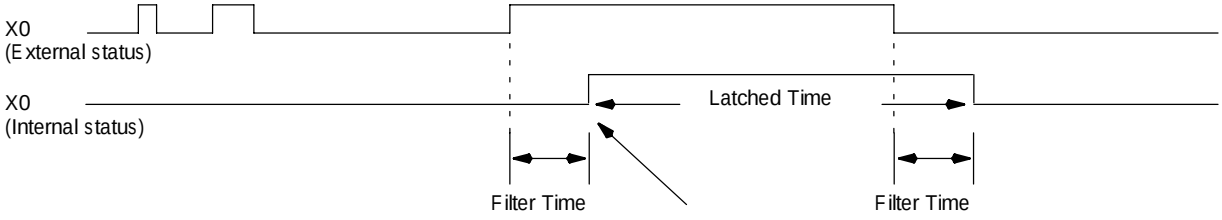
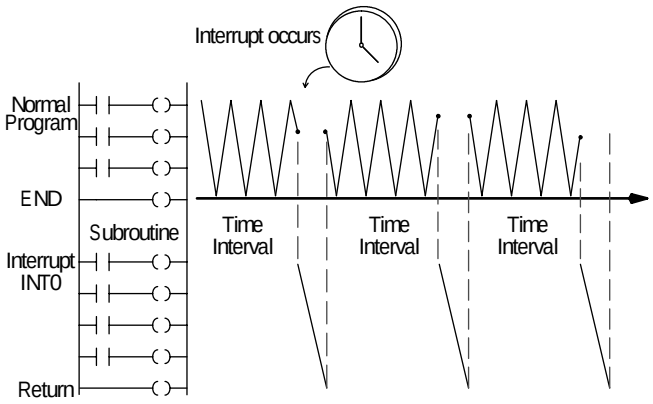
Counter Interface Mode 60

Mode 60: four discrete inputs with filter

With Mode 60 selected, the D2-230, D2-240, and D2-250(-1) and D2-260 CPUs provide filtering for up to four input signals from the Counter Interface. The filtering helps reduce the possibility of false ON conditions triggering the program logic. When an external signal is first detected (ON state), a programmable filter is activated which begins a timed countdown. The slight delay temporarily prevents the CPU from reading the input during the normal input update portion of the scan cycle. The ON signal must stay present long enough for the filter to time out. If the ON signal stays present during the entire filter time, it is latched by the filter and allowed to be accepted by the CPU during the CPU's normal input update portion of the scan cycle. The signal is latched for the remaining duration of the ON signal plus an amount of time equal to the filter time. The filter time can be programmed from 0 to 99ms in 1ms increments.



After the filter delay time, the input is accepted by the CPU.



Counter interface input assignments for timed interrupt mode	
X0	Not available for use
X1	Filtered Input, Interrupt, or Pulse Catch
X2	Filtered Input, Interrupt, or Pulse Catch
X3	Filtered Input, Interrupt, or Pulse Catch

Timed interrupt specifications	
Timed interrupts	One (internal to CPU)
Time interval	3 to 999ms (1 ms increments)
Interrupt Subroutine	INT0

Understanding the Timed Interrupt

There is also a timed interrupt feature available in our D2-240, D2-250(-1) and D2-260 CPUs. You do not have to purchase the Counter Interface module to use the timed interrupt. This cyclical interrupt allows you to easily program a time-based interrupt that occurs on a scheduled basis. The CPU's timed interrupt operates in a similar manner to the external interrupt input, but instead of the interrupt subroutine being triggered by an external event, it is now triggered by a cyclical interval of time. This interval can be programmed from 3ms to 999ms. Whenever the programmed time elapses, the CPU immediately suspends its routine scan cycle and jumps to interrupt subroutine INT 0. As with the other modes, when the subroutine execution is complete, the CPU automatically resumes its routine scan cycle starting at the exact location where it was interrupted. Since the CPU scan time and the interrupt time interval are different, the program gets interrupted at various points in the execution over time. The CPU returns to the point where it left to resume the program execution.

If you do choose to use a timed interrupt and the Counter Interface module, you can do so, but you cannot use X0 on the Counter Interface. If you're using the timed interrupt and a normal discrete module, then there are no restrictions.

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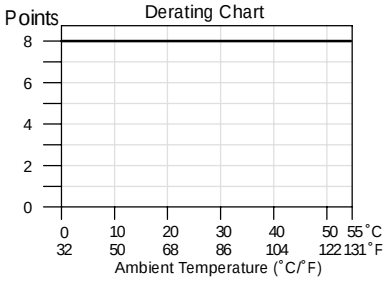
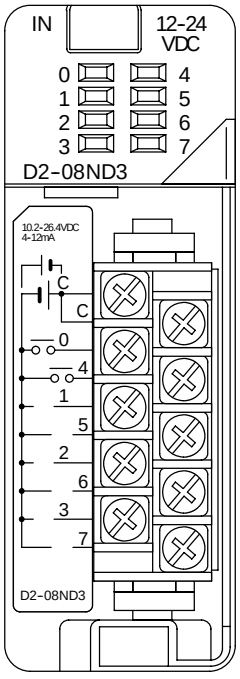
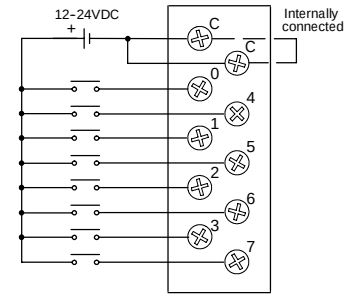
DC INPUT MODULES

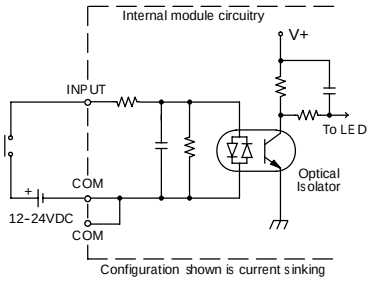
D2-08ND3 DC Input <--->	
Inputs per module	8 (sink/source)
Commons per module	1 (2 I/O terminal points)
Input voltage range	10.2-26.4 VDC
Peak voltage	26.4 VDC
AC frequency	N/A
ON voltage level	9.5 VDC minimum
OFF voltage level	3.5 VDC maximum
Input impedance	2.7K Ω
Input current	4.0mA @ 12VDC 8.5mA @ 24VDC
Minimum ON current	3.5mA
Maximum OFF current	1.5mA
Base power required 5VDC	50mA
OFF to ON response	1 to 8ms
ON to OFF response	1 to 8ms
Terminal Type	Removable
Status Indicator	Logic side
Weight	2.3 oz. (65g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



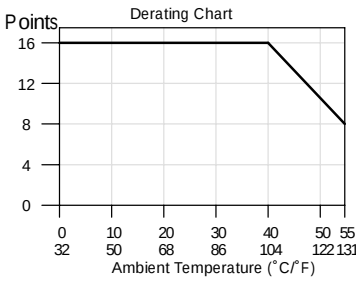


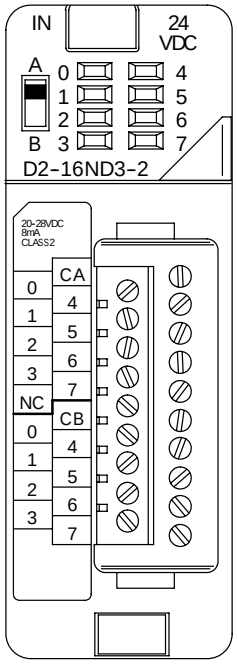


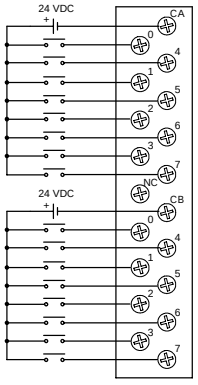


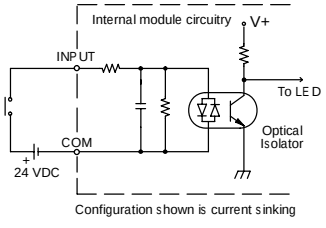
D2-16ND3-2 DC Input <--->	
Inputs per module	16 (sink/source)
Commons per module	2 (isolated)
Input voltage range	20-28 VDC
Peak voltage	30VDC (10mA)
AC frequency	N/A
ON voltage level	19VDC minimum
OFF voltage level	7VDC maximum
Input impedance	3.9K Ω
Input current	6mA @ 24 VDC
Minimum ON current	3.5mA
Maximum OFF current	1.5mA
Base power required 5VDC	100mA
OFF to ON response	3 to 9ms
ON to OFF response	3 to 9ms
Terminal Type	Removable
Status Indicator	Logic side
Weight	2.3 oz. (65g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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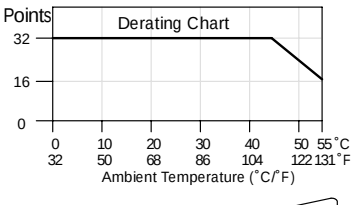
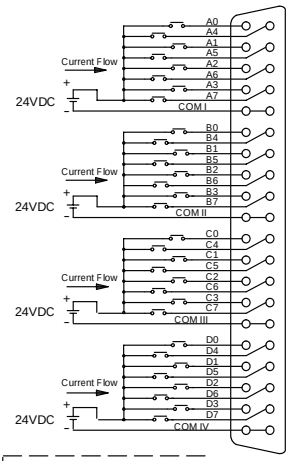
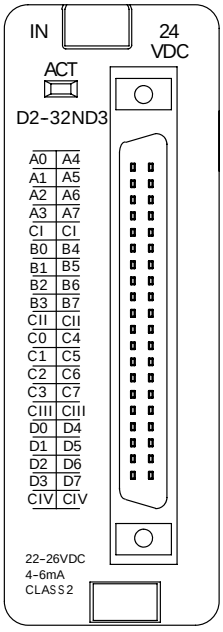
DC Input Modules

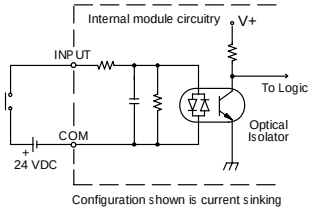
D2-32ND3 DC Input <--->	
Inputs per module	32 (sink/source)
Commons per module	4 (8 I/O terminal points)
Input voltage range	20-28VDC
Peak voltage	30VDC
AC frequency	N/A
ON voltage level	19VDC minimum
OFF voltage level	7VDC maximum
Input impedance	4.8K Ω
Input current	8.0mA @ 24VDC
Minimum ON current	3.5mA
Maximum OFF current	1.5mA
Base power required 5VDC	25mA
OFF to ON response	3 to 9ms
ON to OFF response	3 to 9ms
Terminal Type	Removable 40-pin Connector[1]
Status Indicator	Module Activity LED
Weight	2.1oz. (60g)
[1] Connector sold separately. See Connection Systems for wiring options.	

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



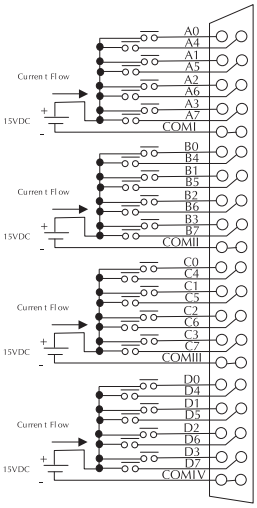


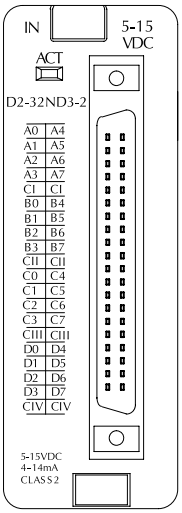


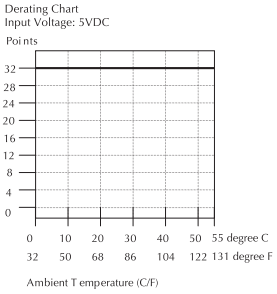


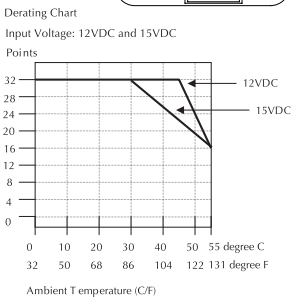
D2-32ND3-2 DC Input <--->	
Inputs per module	32 (Sink/Source)
Commons per module	4 (8 I/O terminal points)
Input voltage range	4.50 to 15.6VDC min. to max.
Peak voltage	16VDC
Input current	4mA @ 5VDC 11mA @ 12VDC 14mA @ 15VDC
Max. input current	16mA @ 15.6VDC
Input impedance	1.0k Ω @ 5-15VDC
ON voltage level	4VDC minimum
OFF voltage level	2VDC maximum
Min. ON current	3mA
Max. OFF current	0.5mA
OFF to ON response	3 to 9ms
ON to OFF response	3 to 9ms
Status indicator	Module activity LED
Terminal type	Removable 40-pin connector[1]
Base power required 5VDC	25mA
Weight	2.1oz (60g)
[1] Connector sold separately. See Connection Systems for wiring options.	

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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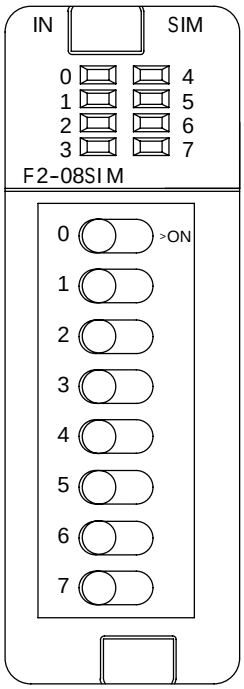
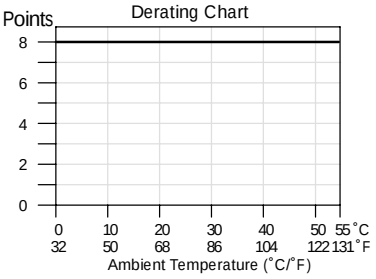
SIMULATOR/AC INPUT MODULES

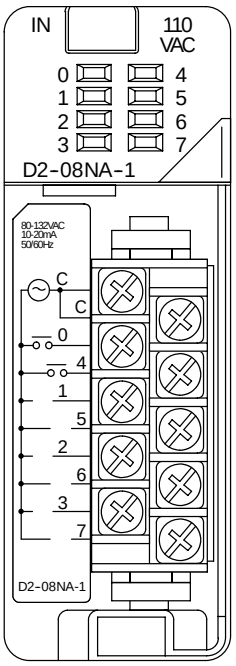
F2-08SIM Input Simulator <--->	
Inputs per module	8
Base power required 5VDC	50mA
Terminal Type	None
Status Indicator	Switch side
Weight	2.65oz. (75g)

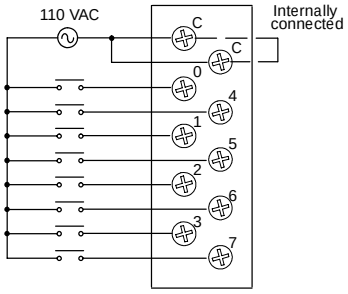


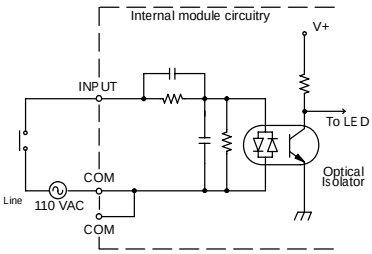
D2-08NA-1 AC Input <--->	
Inputs per module	8
Commons per module	1 (2 I/O terminal points)
Input voltage range	80-132VAC
Peak voltage	132VAC
AC frequency	47-63Hz
ON voltage level	75VAC minimum
OFF voltage level	20VAC maximum
Input impedance	12K Ω@ 60Hz
Input current	13mA @ 100VAC, 60Hz 11mA @ 100VAC, 50Hz
Minimum ON current	5mA
Maximum OFF current	2mA
Base power required 5VDC	50mA
OFF to ON response	5 to 30ms
ON to OFF response	10 to 50ms
Terminal Type	Removable
Status Indicator	Logic side
Weight	2.5oz. (70g)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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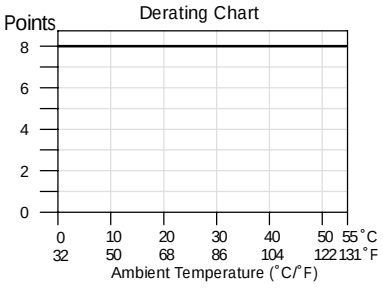
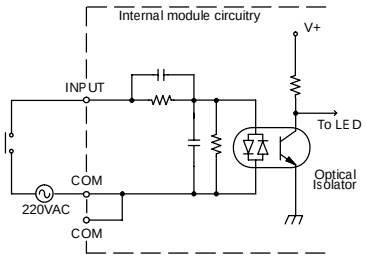
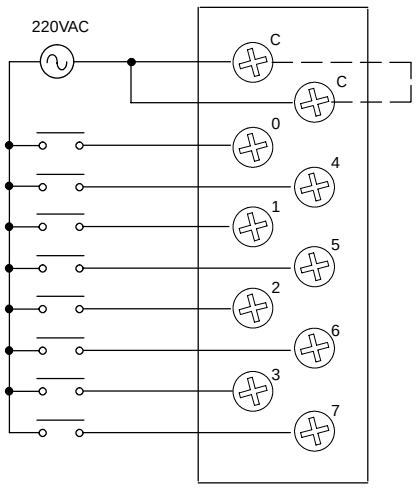
AC Input Modules

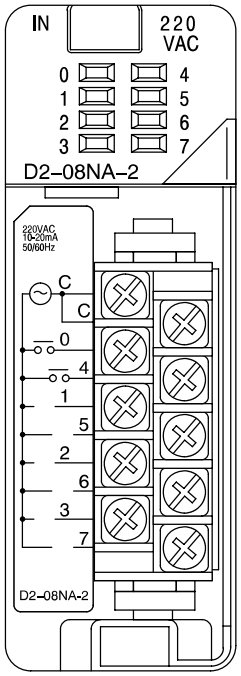
D2-08NA-2 AC Input <--->	
Inputs per module	8
Commons per module	1 (2 I/O terminal points)
Input voltage range	170-265VAC
Peak voltage	265VAC
AC frequency	47-63Hz
ON voltage level	150VAC minimum
OFF voltage level	40VAC maximum
Input impedance	18K Ω @ 60Hz
Input current	9mA @ 220VAC, 50Hz 11mA @ 265VAC, 50Hz 10mA @ 220VAC, 60Hz 12mA @ 265VAC, 60Hz
Minimum ON current	10mA
Maximum OFF current	2mA
Base power required 5VDC	100mA
OFF to ON response	5 to 30ms
ON to OFF response	10 to 50ms

Terminal Type	Removable
Status Indicator	Logic side
Weight	2.5oz. (70g)
Operating Temperature	32ºF to 131ºF (0º to 55ºC)
Storage Temperature	-4ºF to 158ºF (-20ºC to 70ºC)
Humidity	35% to 95% (non-condensing)
Atmosphere	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Insulation Withstand Voltage	1500VAC 1 minute (COM-GND)
Insulation Resistance	10M ≃s 500 VDC
Noise Immunity	NEMA 1500V 1 minute SANKI 1000V 1 minute
RFI	150MHz, 430MHz









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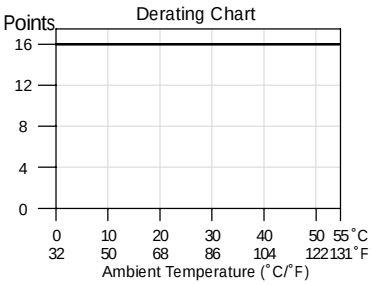
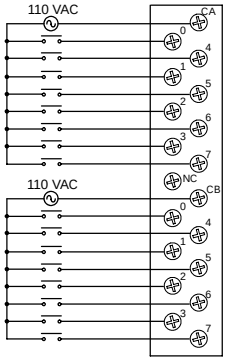
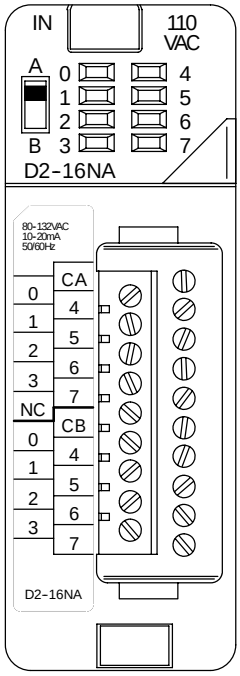
AC Input Modules

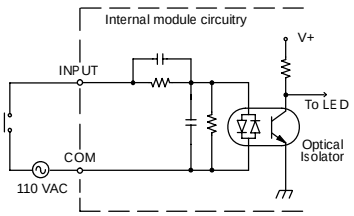
D2-16NA AC Input <--->	
Inputs per module	16
Commons per module	2 (isolated)
Input voltage range	80-132VAC
Peak voltage	132VAC
AC frequency	47-63Hz
ON voltage level	70VAC minimum
OFF voltage level	20VAC maximum
Input impedance	12K Ω @ 60Hz
Input current	11mA @ 100VAC, 50Hz 13mA @ 100VAC, 60Hz 15mA @ 132VAC, 60Hz
Minimum ON current	5mA
Maximum OFF current	2mA
Base power required 5VDC	100mA
OFF to ON response	5 to 30ms
ON to OFF response	10 to 50ms
Terminal Type	Removable
Status Indicator	Logic side
Weight	2.4oz. (68g)



See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.







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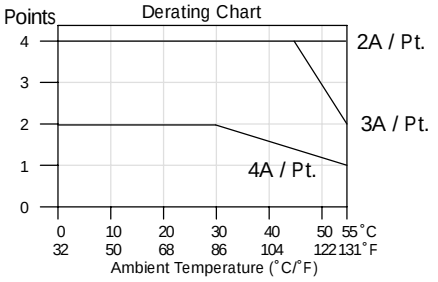
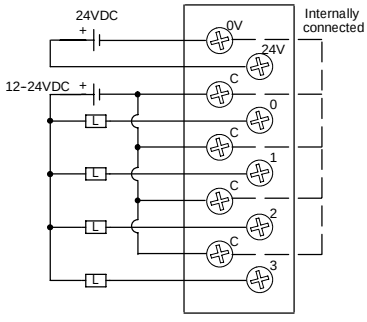
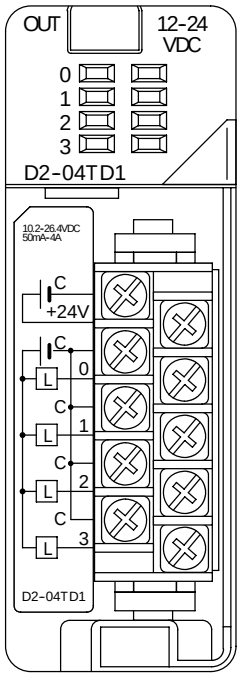
DC Output Modules

D2-04TD1 DC Output <--->	
Outputs per module	4 (current sinking)
Output Points Consumed	8 points (only first 4-pts. used)
Commons per module	1 (4 I/O terminal points)
Operating voltage	10.2-26.4VDC
Output type	NMOS FET (open drain)
Peak voltage	40 VDC
AC frequency	N/A
ON voltage drop	0.72VDC maximum
Max load current (resistive)	4A/point 8A/common
Max leakage current	0.1mA @ 40VDC

Max inrush current	6A for 100ms, 15A for 10ms
Minimum load	50mA
External DC Required	24VDC @ 20mA max.
Base power required 5VDC	60mA
OFF to ON response	1ms
ON to OFF response	1ms
Terminal type	Removable
Status Indicators	Logic side
Weight	2.8oz. (80g)
Fuses	4 (1 per point) (6.3A slow blow, non-replaceable)







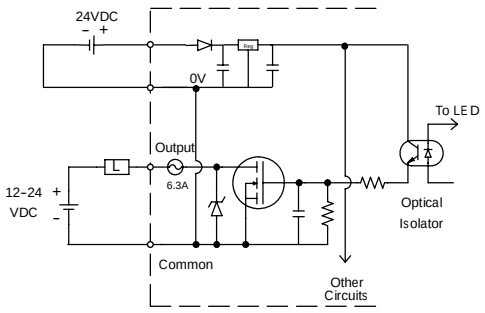
Inductive Load
Maximum Number of Switching Cycles per Minute

Load Current	Duration of output in ON state 7ms	40ms	100ms
0.1A	8000	1400	600
0.5A	1600	300	120
1.0A	800	140	60
1.5A	540	90	35
2.0A	400	70	–
3.0A	270	–	–
4.0A	200	–	–

At 40mS duration, loads of 3.0A or greater cannot be used.

At 100mS duration, loads of 2.0A or greater cannot be used.

Find the load current you expect to use and the duration that the output is ON. The number at the intersection of the row and column represents the switching cycles per minute. For example, a 1A inductive load that is on for 100ms can be switched on and off a maximum of 60 times per minute. To convert this to duty cycle percentage use: (duration x cycles) / 60. In this example (60 x .1)/60 = .1 or 10% duty cycle.



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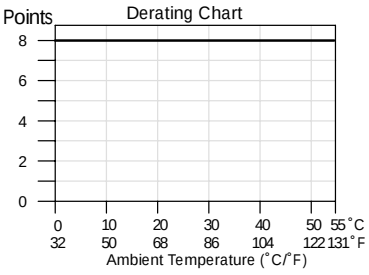
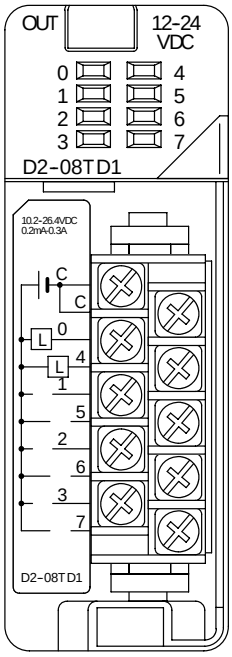
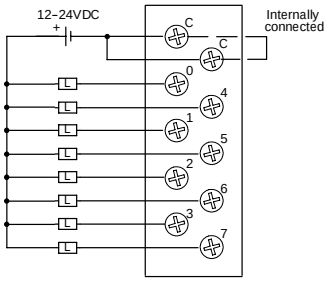
DC OUTPUT MODULES

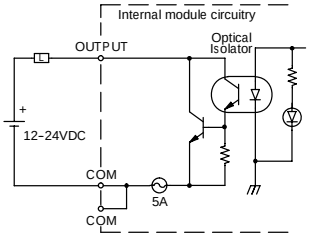
D2-08TD1 DC Output <--->	
Outputs per module	8 (current sinking)
Commons per module	1 (2 I/O terminal points)
Operating voltage	10.2-26.4 VDC
Output type	NPN open collector
Peak voltage	40VDC
AC frequency	N/A
ON voltage drop	1.5VDC maximum
Max load current	0.3A/point, 2.4A/common
Max leakage current	0.1mA @ 40VDC
Max inrush current	1A for 10ms
Minimum load	0.5mA
Base power required 5VDC	100mA
OFF to ON response	1ms
ON to OFF response	1ms
Terminal type	Removable
Status Indicators	Logic side
Weight	2.3oz. (65g)
Fuses	1 per common 5A fast blow, non-replaceable

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



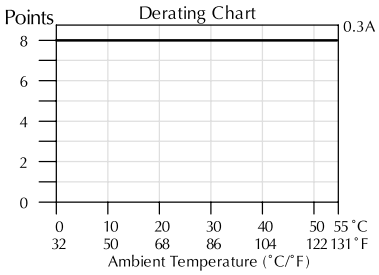


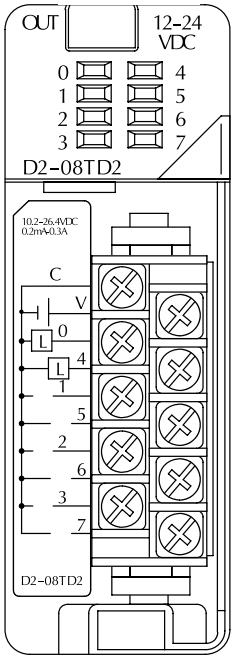


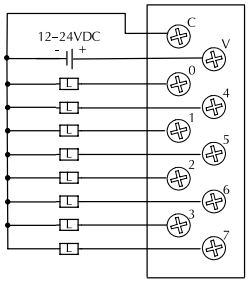


D2-08TD2 DC Output <--->	
Outputs per module	8 (current sourcing)
Commons per module	1
Operating voltage	10.8 to 26.4VDC
Operating voltage range	12 to 24VDC
Output type	PNP open collector
Peak voltage	40VDC
AC frequency	N/A
ON voltage drop	1.5VDC
Max output current	0.3A per point, 2.4A per common
Max leakage current	1.0mA @ 40VDC
Max. inrush current	1A for 10mS
Base power required 5VDC	100mA
OFF to ON response	1mS
ON to OFF response	1mS
Terminal type	Removable
Status indicators	Logic side
Weight	2.1oz. (60g)
Fuse	1 per common 5A fast blow, non-replaceable

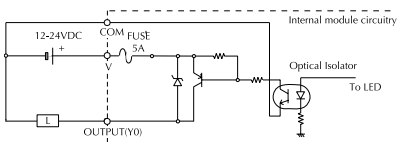
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.







Equivalent Output Circuit



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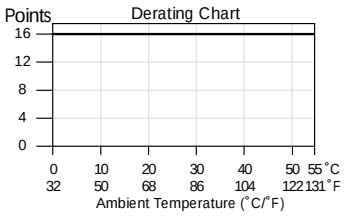
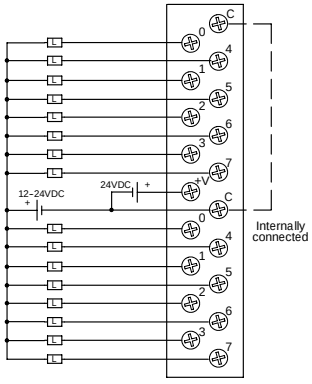
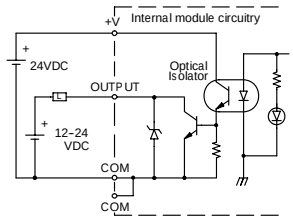
DC Output Modules

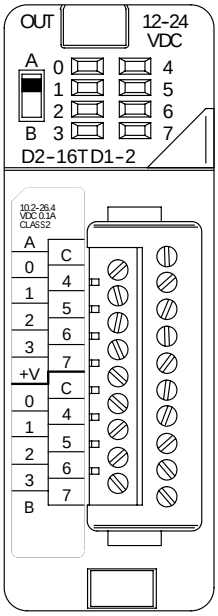
D2-16TD1-2 DC Output <--->	
Outputs per module	16 (current sinking)
Commons per module	1 (2 I/O terminal points)
Operating voltage	10.2-26.4VDC
Output type	NPN open collector
Peak voltage	30VDC
AC frequency	N/A
ON voltage drop	0.5VDC maximum
Max load current	0.1A/point 1.6A/common
Max leakage current	0.1mA @ 30VDC
Max inrush current	150mA for 10ms
Minimum load	0.2mA
Base power required 5VDC	200mA
OFF to ON response	0.5ms
ON to OFF response	0.5ms
Terminal type	Removable
Status Indicators	Logic Side
Weight	2.3oz. (65g)
Fuses	None
External DC required	24VDC ±4V @ 80mA max

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



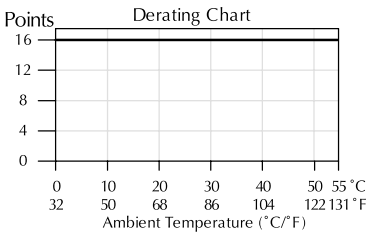


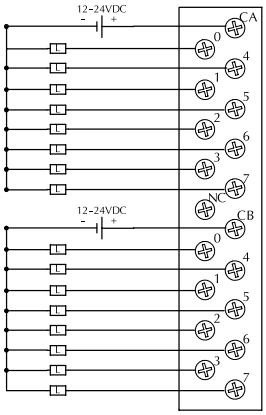


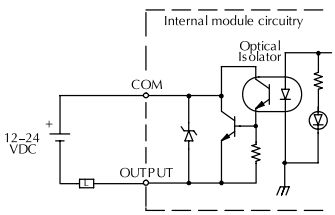


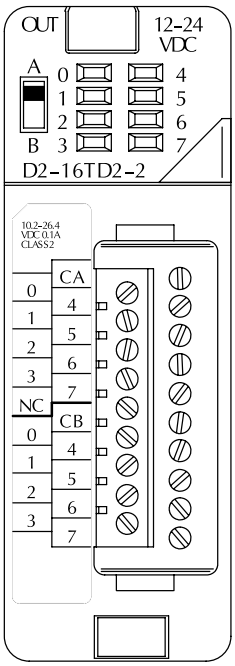
D2-16TD2-2 DC Output <--->	
Outputs per module	16 (current sourcing)
Commons per module	2
Operating voltage	10.2-26.4VDC
Output type	NPN open collector
Peak voltage	30VDC
AC frequency	N/A
ON voltage drop	1.0VDC maximum
Max load current	0.1A/point 1.6A/module
Max leakage current	0.1mA @ 30VDC
Max inrush current	150mA for 10ms
Minimum load	0.2mA
Base power required 5VDC	200mA
OFF to ON response	0.5ms
ON to OFF response	0.5ms
Terminal type	Removable
Status Indicators	Logic Side
Weight	2.8oz. (80g)
Fuses	None

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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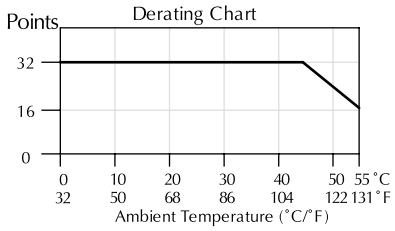
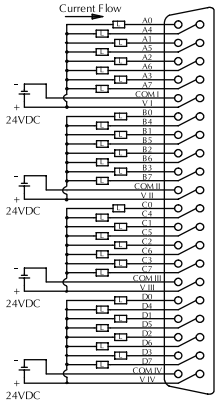
DC OUTPUT MODULES

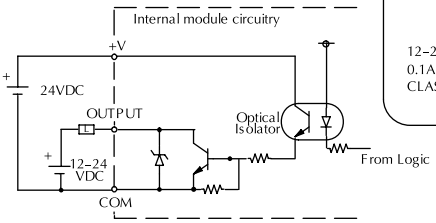
D2-32TD1 DC Output <--->	
Outputs per module	32 (current sinking)
Commons per module	4 (8 I/O terminal points)
Operating voltage	12-24VDC
Peak voltage	30VDC
ON voltage drop	0.5VDC maximum
Max load current	0.1A/point,, max 3.2A per module
Max leakage current	0.1mA @ 30VDC
Max inrush current	150mA for 10ms
Minimum load	0.2mA
Base power required 5VDC	350mA
OFF to ON response	0.5ms
ON to OFF response	0.5ms
Terminal type	removable 40-pin connector[1]
Status indicators	Module activity (no I/O status indicators)
Weight	2.1oz. (60g)
Fuses	None

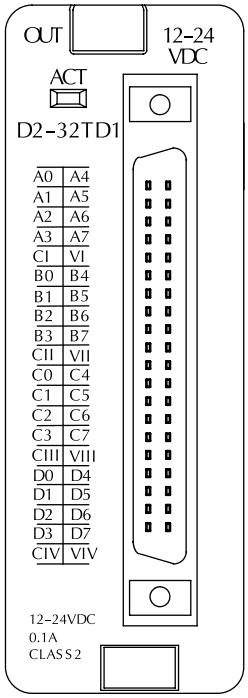
[1] Connector sold separately. See Connection Systems for wiring options.

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.





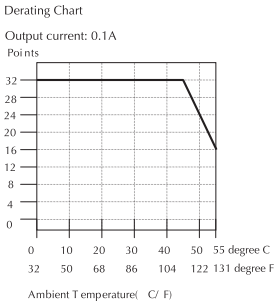


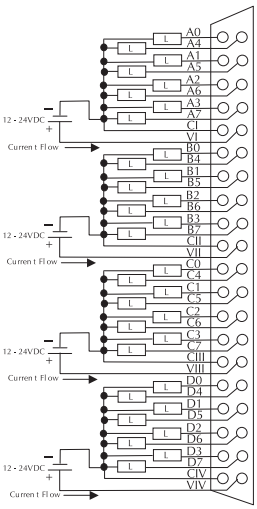


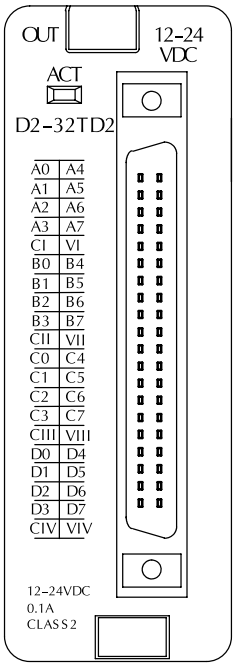
D2-32TD2 DC Output <--->	
Outputs per module	32 (current sourcing)
Commons per module	4 (8 I/O terminal points)
Operating voltage	12 to 24VDC
Peak voltage	30VDC
Max load current	0.1A/point, 0.8A/common
Min load	0.2mA
Max leakage current	0.1mA @ 30VDC
ON voltage drop	0.5VDC @ 0.1A
Max inrush current	150mA @ 10mS
OFF to ON response	0.5mS
ON to OFF response	0.5mS
Statue indicators	Module activity (no I/O status indicators)
Terminal type	Removable 40-pin connector[1]
Weight	2.1oz (60g)
Fuses	None
Base power required 5VDC	350mA

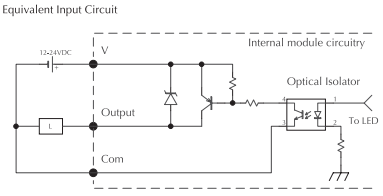
[1] Connector sold separately. See Connection Systems for wiring options.

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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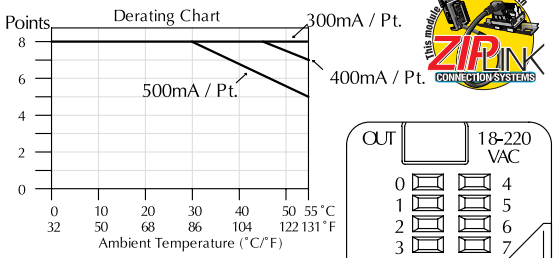
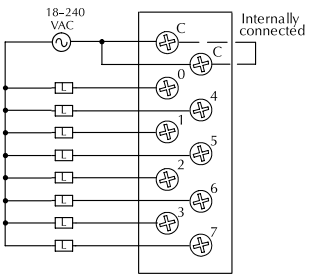
AC Output Modules

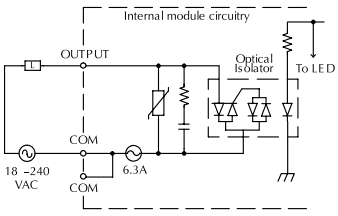
D2-08TA AC Output <--->	
Outputs per module	8
Commons per module	1 (2 I/O terminal points)
Operating voltage	15-264VAC
Output type	SSR (Triac)
Peak voltage	264VAC
AC frequency	47 to 63Hz
ON voltage drop	<1.5VAC (>0.1A) <3.0VAC (<0.1A)
Max load current	0.5A/point 4A/common
Max leakage current	4mA (264VAC, 60Hz) 1.2mA (100VAC, 60Hz) 0.9mA (100VAC, 50Hz)
Max inrush current	10mA for 10ms
Minimum load	10mA
Base power required 5VDC	250 mA
OFF to ON response	1ms
ON to OFF response	1ms + 1/2 cycle
Terminal type	Removable
Status indicators	Logic side
Weight	2.8oz. (80g)
Fuses	1 per common, 6.3A slow blow replaceable order D2-fuse-3

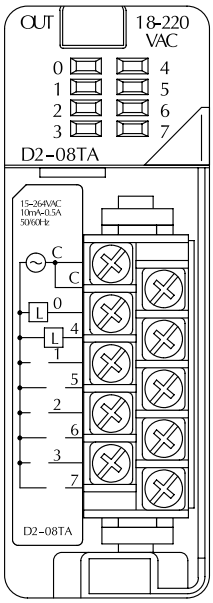
F2-08TA AC Output <--->	
Outputs per module	8
Commons per module	2 (Isolated)
Operating voltage	24-140 VAC
Output type	SSR (Triac with zero crossover)
Peak voltage	140VAC
AC frequency	47 to 63Hz
ON voltage drop	1.6 V (rms) @ 1.5A
Max load current	1.5A / pt @ 30ºC 1.0A / pt @ 60ºC 4.0A / common; 8.0A / module @ 60ºC
Max leakage current	0.7mA (rms)
Peak one cycle surge current	15A
Minimum load	50mA
Base power required 5VDC	250 mA
OFF to ON response	0.5ms - 1/2 cycle
ON to OFF response	0.5ms - 1/2 cycle
Terminal type	Removable
Status indicators	Logic side
Weight	3.5oz.
Fuses	None

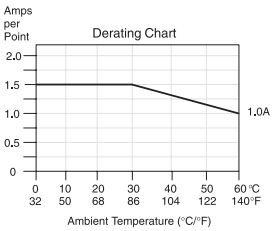
See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



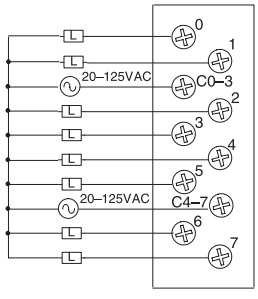


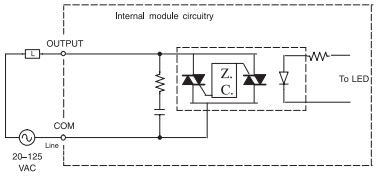


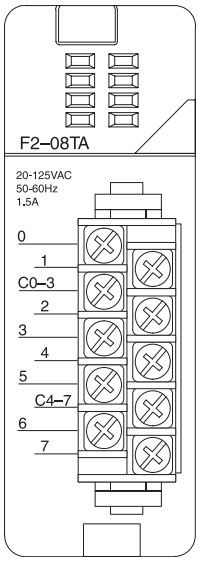




Derating Note: All outputs can be run at the current per point shown. There is no derating for the number of I/O points used.







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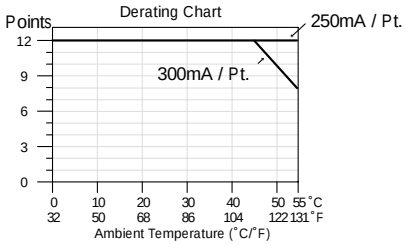
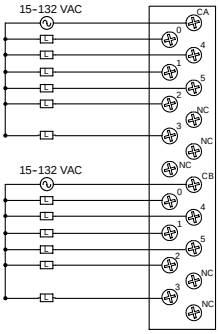
AC Output Modules

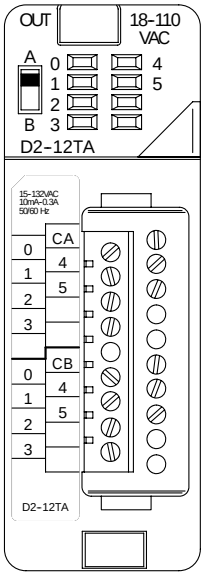
D2-12TA AC Output <--->	
Outputs per module	12
Output point consumed	16 (four unused, see chart below)
Commons per module	2 (isolated)
Operating voltage	15-132VAC
Output type	SSR (Triac)
Peak voltage	132VAC
AC frequency	47 to 63Hz
ON voltage drop	<1.5VAC (>50mA) <4.0VAC (<50mA)
Max load current	0.3A/point 1.8A/common

Max leakage current	2mA (132VAC, 60Hz)
Max inrush current	10A for 10ms
Minimum load	10mA
Base power required 5VDC	350mA
OFF to ON response	1ms
ON to OFF response	1ms + 1/2 cycle
Terminal type	Removable
Status indicators	Logic side
Weight	2.8 oz. (80g)
Fuses	(2) 1 per common 3.15A slow blow, replaceable Order D2-FUSE-1 (5 per pack)

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.



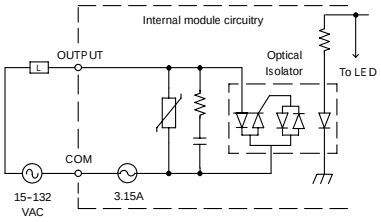




Addresses Used

Points	Used?	Points	Used?
Yn+0	Yes	Yn+10	Yes
Yn+1	Yes	Yn+11	Yes
Yn+2	Yes	Yn+12	Yes
Yn+3	Yes	Yn+13	Yes
Yn+4	Yes	Yn+14	Yes
Yn+5	Yes	Yn+15	Yes
Yn+6	No	Yn+16	No
Yn+7	No	Yn+17	No

n is the starting address



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PLC

Relay Output Modules

D2-04TRS Relay Output <--->	
Outputs per module	4
Commons per module	4 (isolated)
Output Point Consumed	8 (only 1st 4pts. are used)
Operating voltage	5-30VDC / 5-240VAC
Output type	Relay, form A (SPST)
Peak voltage	30VDC, 264VAC
AC frequency	47 to 63Hz
ON voltage drop	0.72VDC maximum
Max load current	4A / point Max. of 8A / module (resistive)
Max leakage current	0.1mA @264VAC

Max inrush current	5A for <10ms
Minimum load	10mA
Base power required 5VDC	250mA
OFF to ON response	10ms
ON to OFF response	10ms
Terminal type	Removable
Status indicators	Logic side
Weight	2.8oz. (80 g)
Fuses	1 per point 6.3A slow blow, replaceable Order D2-FUSE-3 (5 per pack)

Typical Relay Life (Operations)

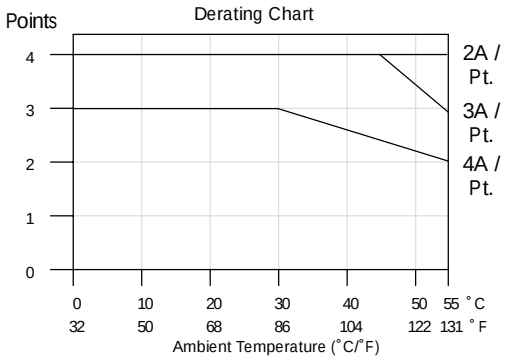
Voltage & Load Current

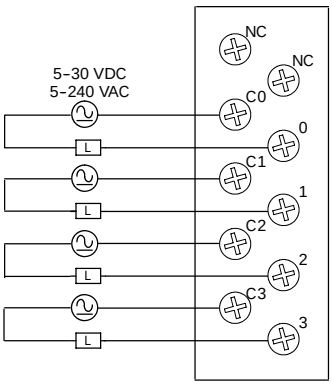
Type of Load	***1A***	***2A***	***3A***	***4A***
24 VDC Resistive	500K	200K	100K	50K
24 VDC Solenoid	100K	40K	—	–
110 VAC Resistive	500K	250K	150K	100K
110 VAC Solenoid	200K	100K	50K	–
220 VAC Resistive	350K	150K	100K	50K
220 VAC Solenoid	100K	50K	—	—

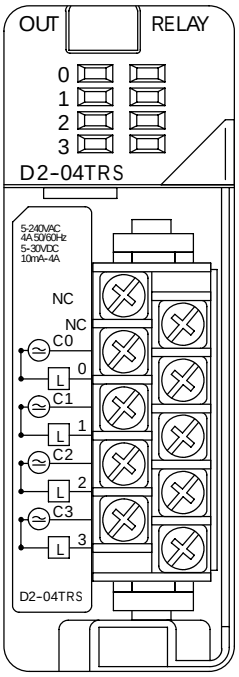
At 24 VDC, solenoid (inductive) loads over 2A cannot be used.

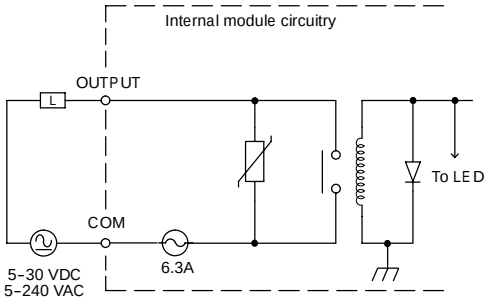
At 100 VAC, solenoid (inductive) loads over 3A cannot be used.

At 220 VAC, solenoid (inductive) loads over 2A cannot be used.









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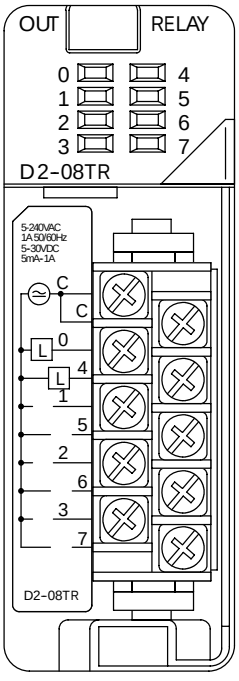
RELAY OUTPUT MODULES

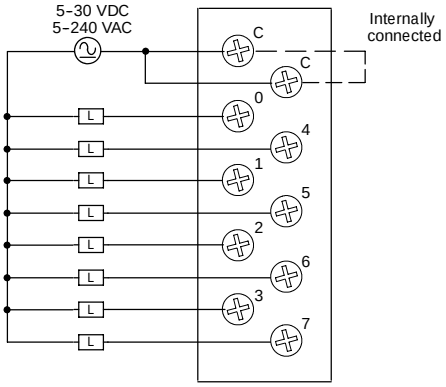
D2-08TR Relay Output <--->	
Outputs per module	8
Commons per module	1 (2 I/O terminals)
Operating voltage	5-30VDC/5-240VAC
Output type	Relay, form A (SPST)
Peak voltage	30VDC, 264VAC
AC frequency	47 to 60Hz
ON voltage drop	N/A
Max current (resistive)	1A/point 4A/common
Max leakage current	0.1mA @265VAC
Max inrush current	Output: 3A for 10ms Common: 10A for 10ms

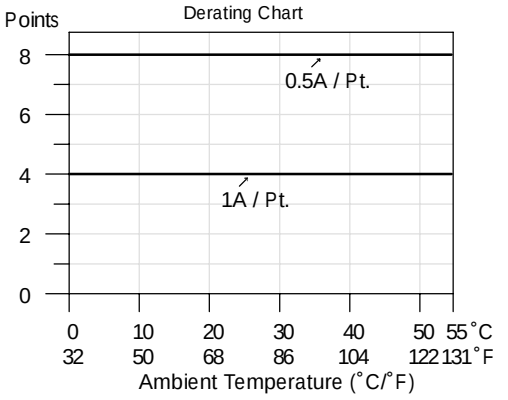
Minimum load	5mA @ 5VDC
Base power required 5VDC	250mA
OFF to ON response	12ms
ON to OFF response	10ms
Terminal type	Removable
Status indicators	Logic side
Weight	3.9oz. (110g)
Fuses	One 6.3A slow blow, replaceable Order D2-FUSE-3 (5 per pack)

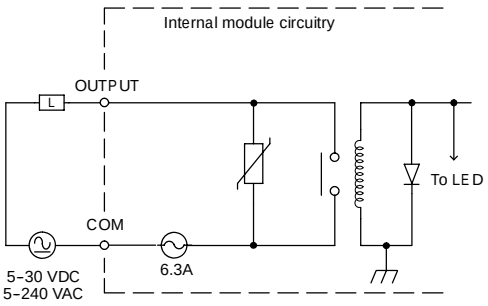
Typical Relay Life (Operations)		
Voltage/Load	***Current***	***Closures***
24VDC Resistive	1A	500K
24VDC Solenoid	1A	100K
110VAC Resistive	1A	500K
110VAC Solenoid	1A	200K
220VAC Resistive	1A	350K
220VAC Solenoid	1A	100K

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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Relay Output Modules

F2-08TRS Relay Output <--->	
Outputs per module	8
Commons per module	8 (isolated)
Output points consumed	8
Operating voltage	12-28VDC, 12-250VAC, 7A 120VDC, 0.5A
Output type	Three, Form C (SPDT) Five, Form A (SPST normally open)
Peak voltage	150VDC, 265VAC
AC frequency	47 to 63Hz
ON voltage drop	N/A
Max load current (resistive)	7A/point [3] (subject to derating)

Max leakage current	N/A
Max inrush current	12A
Minimum load	10mA @ 12VDC
Base power required 5VDC	670mA
OFF to ON response	15ms (typical)
ON to OFF response	5ms (typical)
Terminal type	Removable
Status indicators	Logic side
Weight	5.5oz. (156g)
Fuses	None

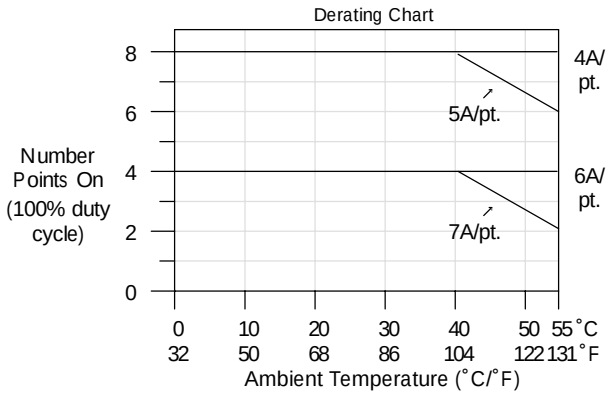
Typical Relay Life[1] (Operations) at Room Temperature

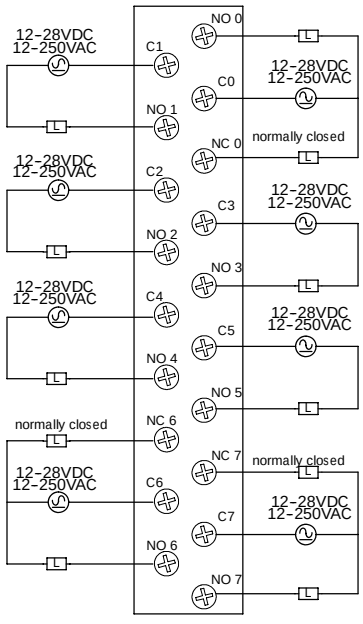
Voltage & Type of Load [2]	***Load Current 50mA***	***5A***	***7A***
24 VDC Resistive	10M	600K	300K
24VDC Solenoid	-	150K	75K
110VAC Resistive	–	600K	300K
110VAC Solenoid	–	500K	200K
220VAC Resistive	–	300K	150K
220VAC Solenoid	–	250K	100K

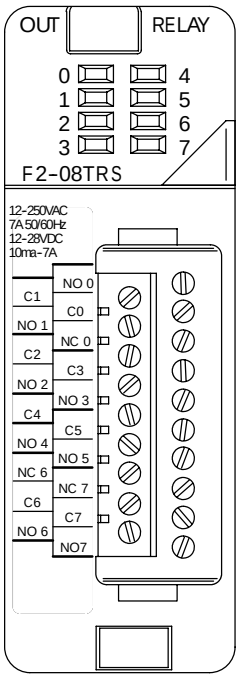
1 Contact life may be extended beyond those values shown with the use of arc suppression techniques described in the DL205 User Manual. Since these modules have no leakage current, they do not have built-in snubber. For example, if you place a diode across a 24VDC inductive load, you can significantly increase the life of the relay.

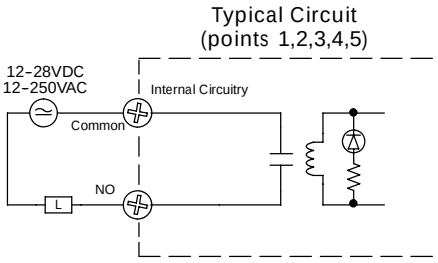
2 At 120 VDC 0.5A resistive load, contact life cycle is 200K cycles.

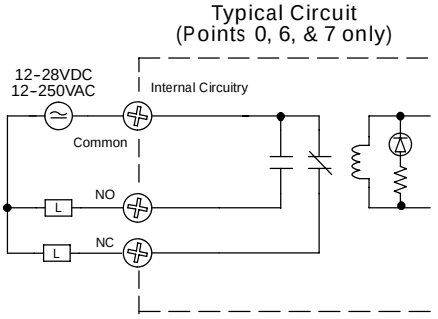
3 Normally closed contacts have 1/2 the current handling capability of the normally open contacts.











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RELAY OUTPUT MODULES

F2-08TR Relay Output <--->	
Outputs per module	8
Commons per module	2 (isolated), 4-pts. per common
Output points consumed	8
Operating voltage	12-28VDC, 12-250VAC, 7A 120VDC, 0.5A
Output type	8, Form A (SPST normally open)
Peak voltage	150VDC, 265VAC
AC frequency	47 to 63Hz
ON voltage drop	N/A
Max load current (resistive)	10A/point [3] (subject to derating) Max of 10A/common

Max leakage current	N/A
Max inrush current	12A
Minimum load	10mA @ 12VDC
Base power required 5VDC	670mA
OFF to ON response	15ms (typical)
ON to OFF response	5ms (typical)
Terminal type	Removable
Status indicators	Logic side
Weight	5.5oz. (156g)
Fuses	None

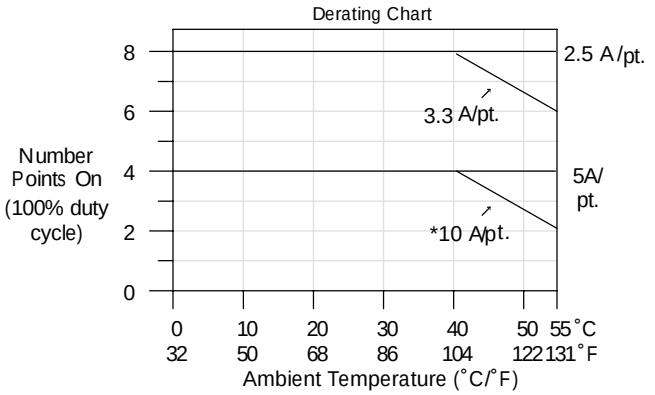
Typical Relay Life[1] (Operations) at Room Temperature

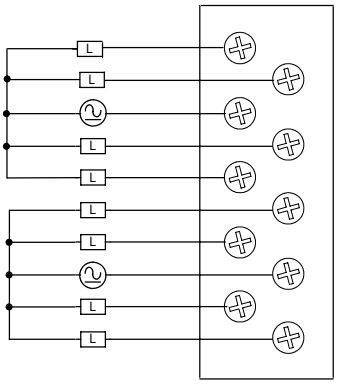
Voltage & Type of Load [2]	*Load Current*		
	50mA	***5A***	***7A***
24 VDC Resistive	10M	600K	300K
24VDC Solenoid	-	150K	75K
110VAC Resistive	–	600K	300K
110VAC Solenoid	–	500K	200K
220VAC Resistive	–	300K	150K
220VAC Solenoid	–	250K	100K

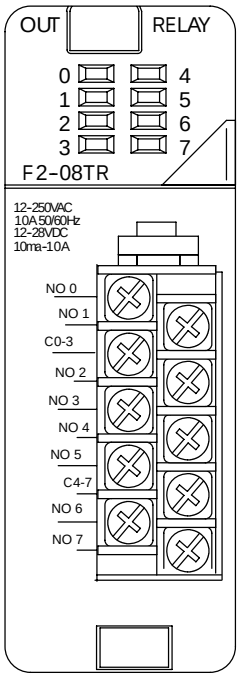
1 Contact life may be extended beyond those values shown with the use of arc suppression techniques described in the DL205 User Manual. Since these modules have no leakage current, they do not have built-in snubber. For example, if you place a diode across a 24VDC inductive load, you can significantly increase the life of the relay.

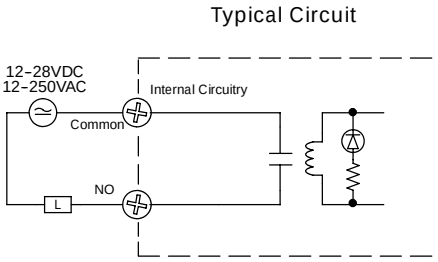
2 At 120 VDC 0.5A resistive load, contact life cycle is 200K cycles.

3 Normally closed contacts have 1/2 the current handling capability of the normally open contacts.









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Relay Output Modules

D2-12TR Relay Output <--->	
Outputs per module	12
Outputs consumed	16 (four unused, see chart below)
Commons per module	2 (6-pts. per common)
Operating voltage	5-30VDC/5-240VAC
Output type	Relay, form A (SPST)
Peak voltage	30VDC, 264VAC
AC frequency	47 to 60Hz
ON voltage drop	N/A
Max current (resistive)	1.5A/point Max of 3A/common
Max leakage current	0.1mA @ 265 VAC

Max inrush current	Output: 3A for 10ms Common: 10A for 10ms
Minimum load	5mA @ 5VDC
Base power required 5VDC	450mA
OFF to ON response	10ms
ON to OFF response	10ms
Terminal type	Removable
Status indicators	Logic side
Weight	4.6oz. (130g)
Fuses	2 4A slow blow, replaceable Order D2-FUSE-4 (5 per pack)

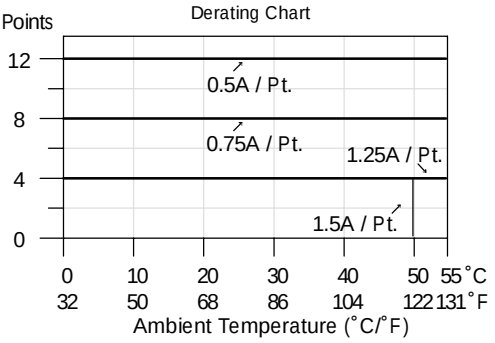
Typical Relay Life (Operations)

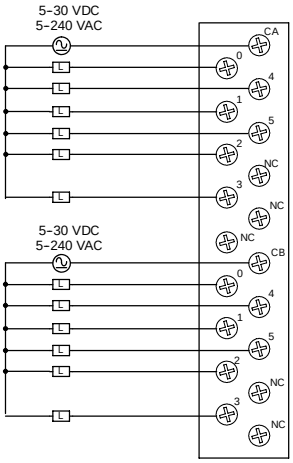
Voltage/Load	*Current*	*Closures*
24VDC Resistive	1A	500K
24VDC Solenoid	1A	100K
110VAC Resistive	1A	500K
110VAC Solenoid	1A	200K
220VAC Resistive	1A	350K
220VAC Solenoid	1A	100K

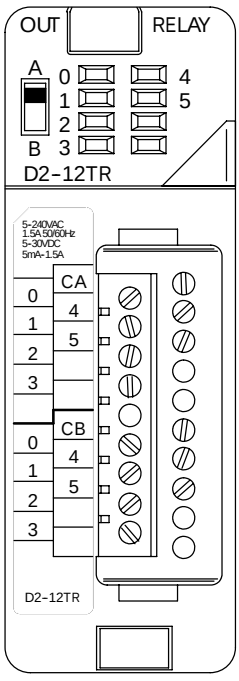
Addresses Used

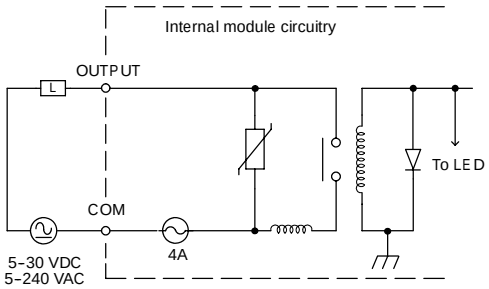
Points	*Used?*	*Points*	*Used?*
Yn+0	Yes	Yn+10	Yes
Yn+1	Yes	Yn+11	Yes
Yn+2	Yes	Yn+12	Yes
Yn+3	Yes	Yn+13	Yes
Yn+4	Yes	Yn+14	Yes
Yn+5	Yes	Yn+15	Yes
Yn+6	No	Yn+16	No
Yn+7	No	Yn+17	No
n is the starting address			

See the Connection Systems section in this desk reference for part numbers of *ZIP*Link cables and terminal blocks compatible with this module.









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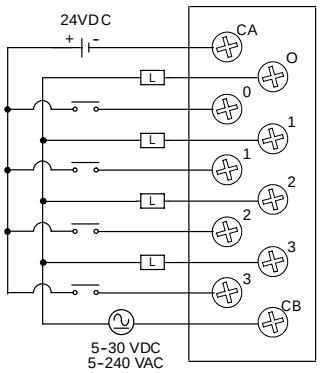
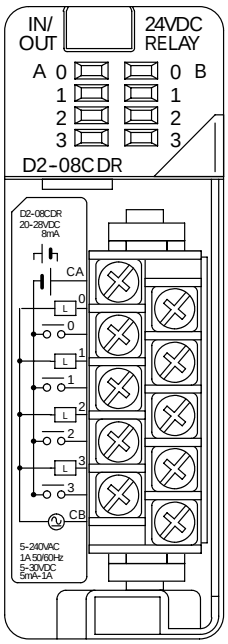
DC INPUT/RELAY OUTPUT MODULE

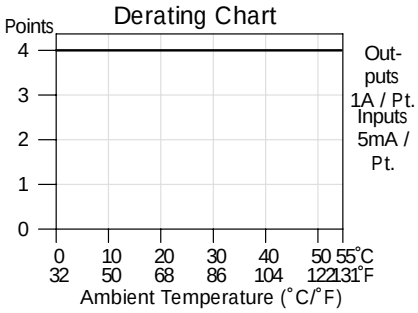
D2-08CDR 4-pt. DC In/4pt. Relay Out <--->	
Input Specifications	
Inputs per module	4 (sink/source)
Input point consumed	8 (only first 4-pts. are used)
Input commons per module	1
Input voltage range	20-28VDC
Peak voltage	30VDC
AC frequency	N/A
ON voltage level	19VDC minimum
OFF voltage level	7VDC maximum
Input impedance	4.7K Ω
Input current	5mA @ 24VDC
Maximum current	8mA @ 30VDC
Minimum ON current	4.5mA
Maximum OFF current	1.5mA
OFF to ON response	1 to 10ms
ON to OFF response	1 to 10ms
Fuse (input circuits)	None
General Specifications	
Base power required 5VDC	200mA
Terminal type	Removable
Status indicators	Logic side
Weight	3.5oz. (100g)

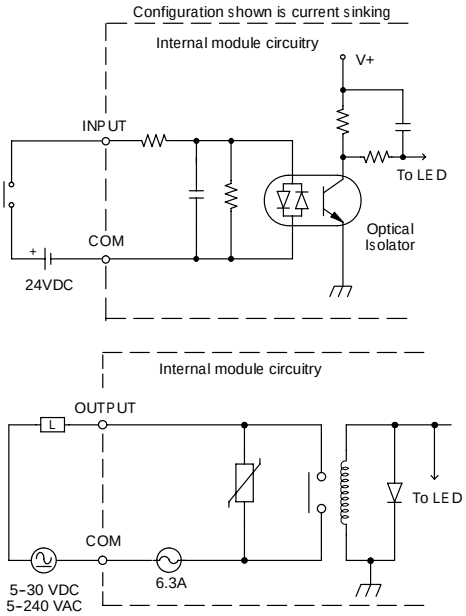
D2-08CDR 4-pt. DC In/4-pt. Relay Out	
Output Specifications	
Outputs per module	4
Output points consumed	8 (only first 4-pts. are used)
Output Commons per module	1
Operating voltage	5-30VDC/5-240VAC
Output type	Relay, form A (SPST)
Peak voltage	30VDC, 264VAC
AC frequency	47 to 63Hz
Max load current (resistive)	1A/point 4A/module (resistive)
Max leakage current	0.1mA @ 264VAC
Max inrush current	3A for <100ms 10A for <10ms (common)
Minimum load	5mA @ 5VDC
OFF to ON response	12ms
ON to OFF response	10ms
Fuse (output circuits)	1 (6.3A slow blow, replaceable) Order D2-FUSE-3 (5 per pack)

Typical Relay Life (Operations)		
Voltage/Load	***Current***	***Closures***
24VDC Resistive	1A	500K
24VDC Solenoid	1A	100K
110VAC Resistive	1A	500K
110VAC Solenoid	1A	200K
220VAC Resistive	1A	350K
220VAC Solenoid	1A	100K









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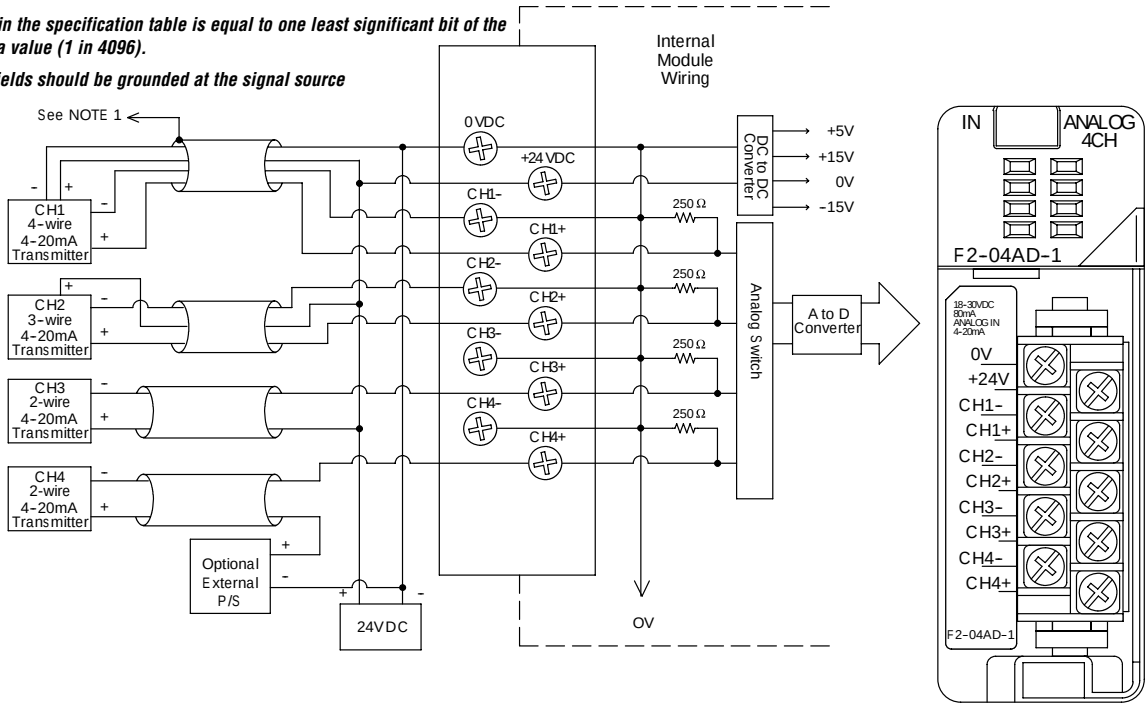
Analog Current Input Modules

F2-04AD-1 4-Channel 4-20mA Analog In <--->	
This module requires a 24 VDC user power supply for operation. See the F2-04AD-1L on the next page if you want to use a 12VDC supply. All other specifications are the same.	
Number of channels	4, single ended (1 common)
Input Ranges	4 to 20mA current
Resolution	12-bit (1 in 4096)
Active Low-pass Filtering	-3dB at 80Hz,2 poles (-12dB per octave)
Input Impedance	250Ω ±0.1%, 1/2W current input
Absolute Maximum Ratings	-40mA to +40mA, current input
Converter Type	Successive approximation
Conversion Time (PLC Update Rate)	1 channel per scan maximum (D230 CPU) 4 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±12 counts max., @ 20mA current input
Offset Calibration Error	±7 counts max.,@ 4mA current input
Step Response	4ms to 95% of F.S. change

Maximum Inaccuracy	±.5% @ 77ºF (25ºC) ±.65% 32º to 140ºF (0º to 60ºC)
Accuracy vs. Temperature	±50ppm/ºC maximum full scale (including max. offset change)
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Digital Input Points Required	16 (X) input points (12 binary data bits, 2 channel ID bits, 2 diagnostic bits)
Base power required 5VDC	50mA
External Power Supply	80mA maximum, +18 to +30VDC
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4º to 158ºF (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source



More than one external power supply can be used provided all the power supply commons are connected. A Series 217, 0.032A, fast-acting fuse is recommended for 4-20mA current loops. If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20mA transmitter types are:

2 or 3 wire: Isolation between input signal and power supply.

4 wire: Isolation between input signal, power supply, and 4-20mA output

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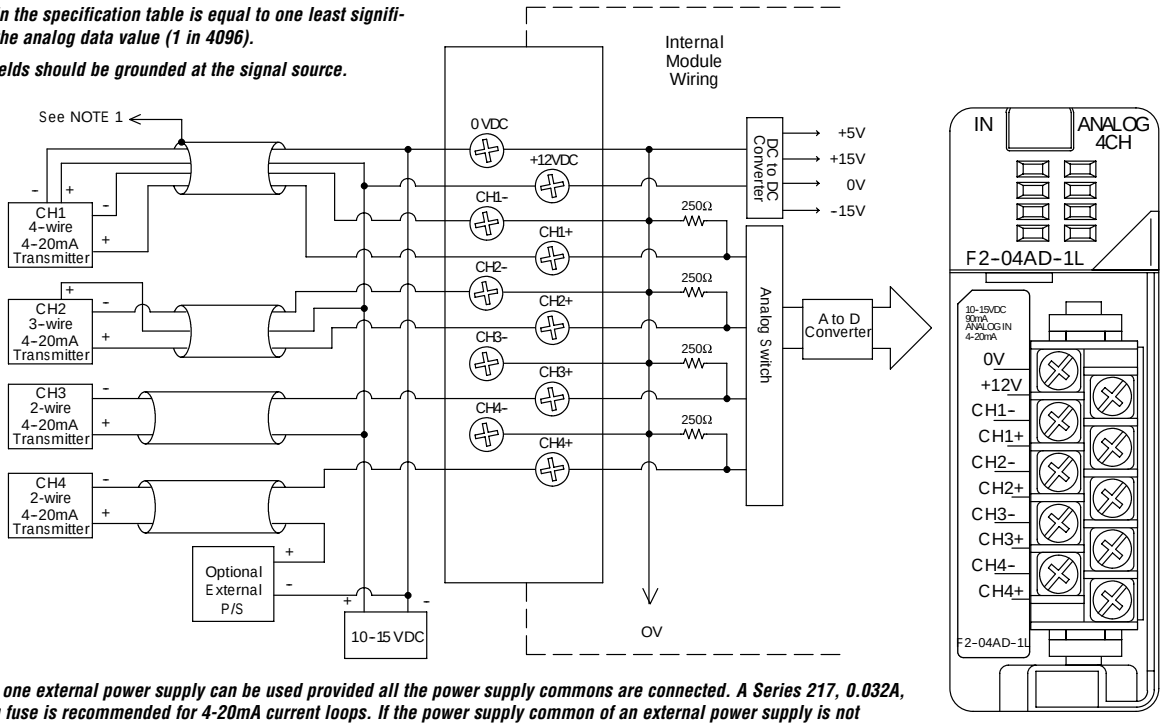
ANALOG CURRENT INPUT MODULES

F2-04AD-1L 4-Ch. 4-20mA Analog In <--->	
This module requires a 12VDC user power supply for operation. See the F2-04AD-1 on the previous page if you want to use a 24VDC supply. All other specifications are the same.	
Number of Channels	4, single ended (1 common)
Input Ranges	4 to 20mA current
Resolution	12 bit (1 in 4096)
Active Low-pass Filtering	-3dB at 80Hz, 2 poles (-12dB per octave)
Input Impedance	250Ω ±0.1%, 1/2W current input
Absolute Maximum Ratings	-40mA to +40mA, current input
Converter Type	Successive approximation
Conversion Time (PLC Update Rate)	1 channel per scan maximum (D2-230 CPU) 4 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±12 counts max., @ 20mA current output
Offset Calibration Error	±7 counts max., @4mA current input
Step Response	4ms to 95% of F.S. change

Maximum inaccuracy	±.5% @ 77ºF (25ºC) ±.65% 32º to 140ºF (0º to 60ºC)
Accuracy vs. Temperature	±50ppm/ºC maximum full scale (including max. offset change)
Recommended Fuse	0.032A, Series 217 fast acting current inputs
Digital Input Points Required	16 (X) input points (12 binary data bits, 2 channel ID bits, 2 diagnostic bits)
Base Power Required 5VDC	50mA
External Power Supply	90mA maximum, +10 to +15VDC
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4º to 158ºF (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source.



More than one external power supply can be used provided all the power supply commons are connected. A Series 217, 0.032A, fast-acting fuse is recommended for 4-20mA current loops. If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20mA transmitter types are:

2 or 3 wire: Isolation between input signal and power supply.
4 wire: Isolation between input signal, power supply, and 4-20mA output

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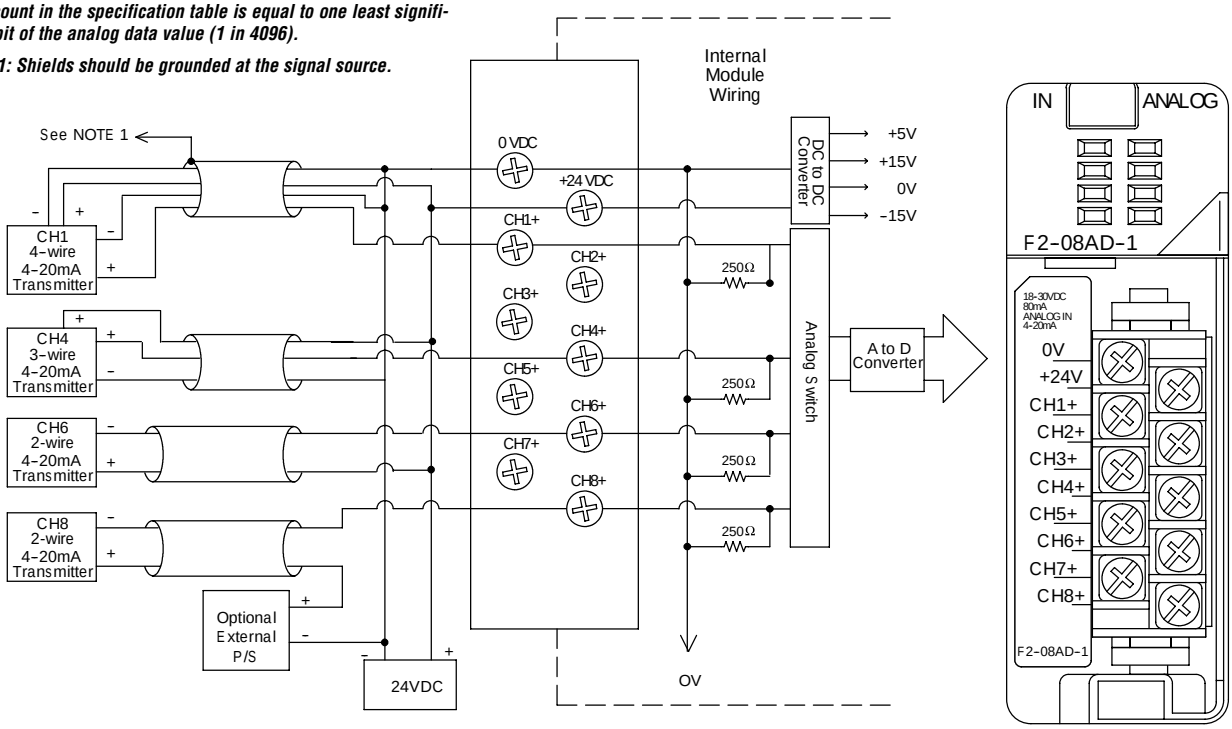
Analog Current Input Modules

F2-08AD-1 8-Channel 4-20mA Analog In <--->	
Number of Channels	8, single ended (1 common)
Input Ranges	4 to 20mA current
Resolution	12 bit (1 in 4096)
Low-pass Filtering	-3dB at 200Hz, (-6dB per octave)
Input Impedance	250Ω ±0.1%, 1/2W current input
Absolute Maximum Ratings	-45mA to +45mA
Converter Type	Successive approximation
Conversion Time (PLC Update Rate)	(D2-230 CPU) 1 channel per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs) 8 channels per scan maximum
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±5counts max., @ 20mA current input
Offset Calibration Error	±2 counts max., @ 4mA current input
Step Response	7ms to 95% of F.S. change

Maximum Inaccuracy	±.1% @ 77ºF (25ºC) ±.25% 32º to 140ºF (0º to 60ºC)
Accuracy vs. Temperature	±50ppm/ºC maximum full scale (including max. offset change of two counts)
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Digital Input Points Required	16 (X) input points (12 binary data bits, 3 channel ID bits, 1 broken transmitter bit)
Base Power Required 5VDC	50mA
External Power Supply	80mA maximum, +18 to +30VDC
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4º to 158ºF (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source.



More than one external power supply can be used provided all the power supply commons are connected. A Series 217, 0.032A, fast-acting fuse is recommended for 4-20mA current loops. If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20mA transmitter types are:

2 or 3 wire: Isolation between input signal and power supply.
4 wire: Isolation between input signal, power supply, and 4-20mA output

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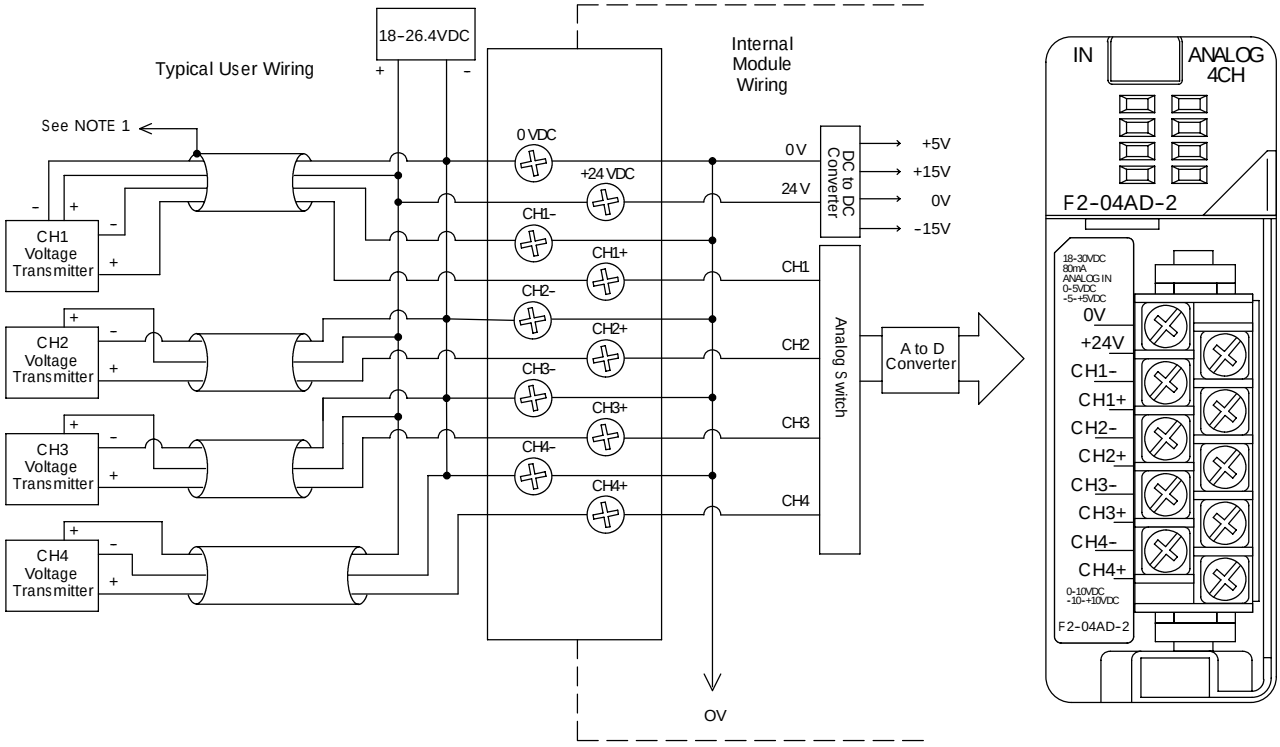
ANALOG VOLTAGE INPUT MODULES

F2-04AD-2 4-Channel Voltage Analog In <--->	
This module requires a 24VDC user power supply for operation. See the F2-04AD-2L on the next page if you want to use a 12VDC supply. All other specifications are the same.	
Number of Channels	4, single ended (1 common)
Input Ranges	0 to 5V, 0 to 10V, ±5V, ±10V
Resolution	12 bit (1 in 4096)
Active Low-pass Filtering	-3dB at 80Hz, 2 poles (-12dB per octave)
Input Impedance	>20MΩ
Absolute Maximum Ratings	-75 to +75VDC
Converter Type	Successive approximation
Conversion Time (PLC Update Rate)	1 channel per scan maximum (D2-230 CPU) 4 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum ±2 counts maximum (bi-polar)
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±3 counts maximum
Offset Calibration Error	±1 count maximum (0V input)
Step Response	10ms to 95% of F.S change

Maximum Inaccuracy	±.1% @ 77ºF (25ºC) ±.3% 32º to 140ºF (0º to 60ºC)
Accuracy vs. Temperature	±50ppm/ºC full scale calibration change (including maximum offset change)
Digital Input Points Required	16(x) input points (12 binary data bits, 2 channel ID bits)
Base Power Required 5VDC	60mA
External Power Supply	90mA maximum, +18 to +30VDC
Operating Temperature	32º to 140ºF (0 to 60ºC)
Storage Temperature	-4º to 158°F (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source.



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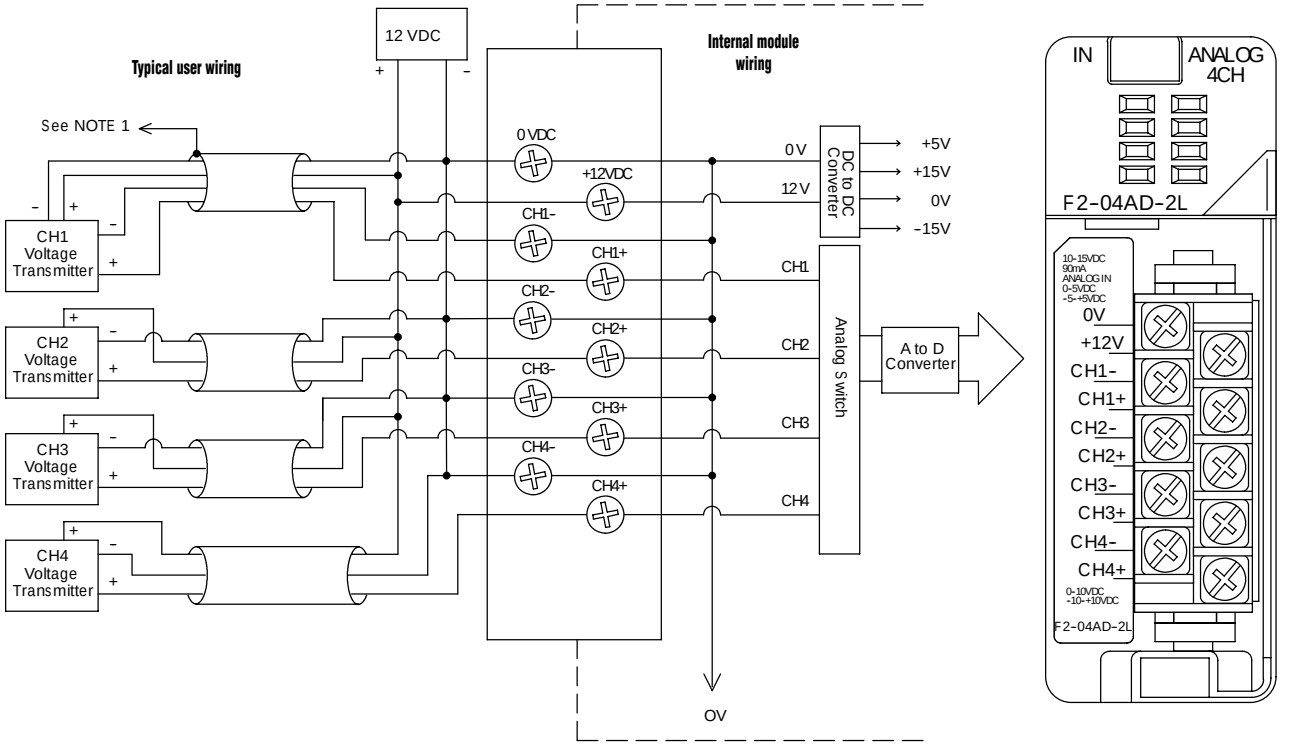
Analog Voltage Input Modules

F2-04AD-2L 4-Ch. Voltage Analog In <--->	
This module requires a 12VDC user power supply for operation. See the F2-04AD-2 if you want to use a 24VDC supply. All other specifications are the same.	
Number of Channels	4, single ended (1 common)
Input Ranges	0 to 5V, 0 to 10V, ±5V, ±10V
Resolution	12 bit (1 in 4096)
Active Low-pass Filtering	-3dB at 80Hz, 2 poles (-12 dB per octave)
Input Impedance	>20MΩ
Absolute Maximum Ratings	-75 to +75VDC
Converter Type	Successive approximation
Conversion Time (PLC Update Rate)	1 channel per scan maximum (D2-230 CPU) 4 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum ±2 counts maximum (bi-polar)
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±3 counts maximum
Offset Calibration Error	±1 count maximum (0V input)
Step Response	10ms to 95% of F.S change

Maximum Inaccuracy	±.1% @ 77ºF (25ºC) ±.3% 32º to 140ºF (0º to 60ºC)
Accuracy vs. Temperature	±50ppm/ºC full scale calibration change (including maximum offset change of 2 counts)
Digital Input Points Required	16 (X) input points (12 binary data bits, 2 channel ID bits)
Base Power Required 5VDC	60mA
External Power Supply	90mA maximum, +10 to +15 VDC
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4º to 158ºF (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source.



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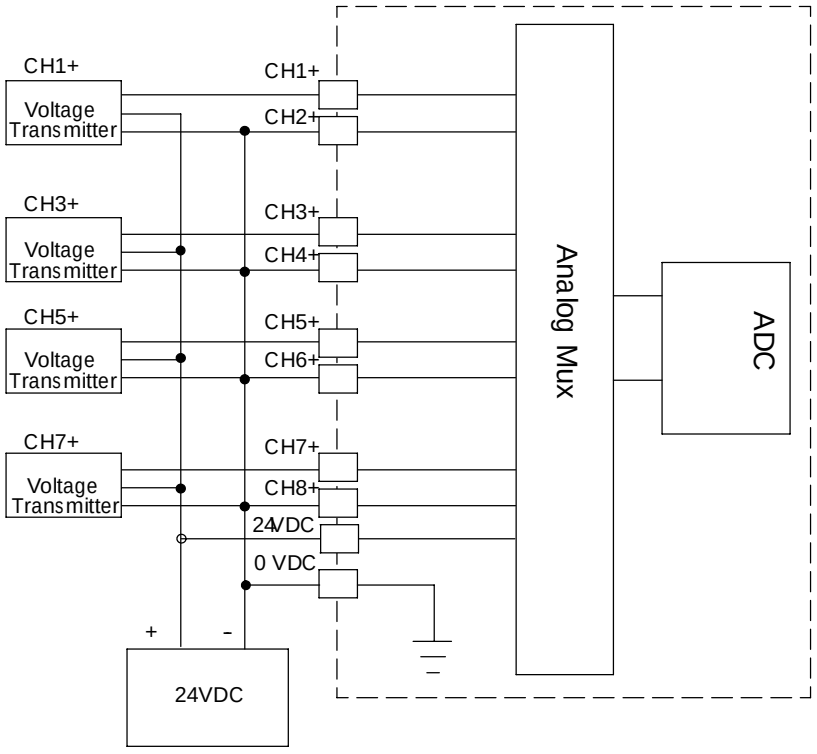
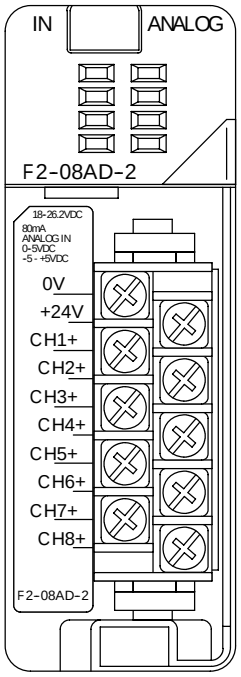
ANALOG VOLTAGE INPUT MODULES

F2-08AD-2 8-Channel Voltage Analog In <--->	
Number of Channels	8, single ended (1 common)
Input Ranges	0 to 5V, 0 to 10V, ±5V, ±10VDC
Resolution	12 bit (1 in 4095) uni-polar 13 bit (-4095 to 4095) bi-polar
Active Low-pass Filtering	-3dB at 200Hz, (-6 dB per octave)
Input Impedance	>20MΩ
Absolute Maximum Ratings	-75 to +75VDC
Converter Type	Successive approximation
Conversion Time (PLC Update Rate)	1 channel per scan maximum (D2-230 CPU) 8 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Input Stability	±1 count
Full Scale Calibration Error (offset error not included)	±3 counts maximum
Offset Calibration Error	±1 count maximum (0V input)
Step Response	4ms to 95% of F.S. change

Maximum Inaccuracy	±.1% @ 77°F (25°C) ±.3% 32° to 140°F (0° to 60°C)
Accuracy vs. Temperature	±50ppm/°C maximum full scale (including max. offset change of 2 counts)
Digital Input Points Required	16 (X) input points, (12 binary data bits, 3 channel ID bits, 1 sign bit, 1 diagnostic bit)
Base Power Required 5VDC	60mA
External Power Supply	80mA maximum, +18 to +26.4VDC
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096). Includes circuitry to automatically detect broken or open transmitters.





Note 1: Connect unused channels (CH2+, CH4+, CH6+, CH8+) to common.

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TEMPERATURE INPUT MODULES

F2-04RTD 4-Channel RTD In <--->	
Number of Channels	4
Input Ranges	Type Pt100: -200.0/850.0°C, -328/1562°F Type Pt1000: -200.0/595.0°C, -328/1103°F Type jPt100: -38.0/450.0°C, -36/842°F Type CU-10/25 : -200.0/260.0°C, -328/500°F
Resolution	16 bit (1 in 65535)
Display Resolution	±0.1°C, ±0.1°F (±3276.7)
RTD Excitation Current	200µA
Input Type	Differential
Notch Filter	>100 db notches at 50/60Hz -3db=13.1Hz
Maximum Setting Time	100ms (full-scale step input)
Common Mode Range	0-5VDC
Absolute Maximum Ratings	Fault protected inputs to ±50VDC
Sampling Rate	160ms per channel

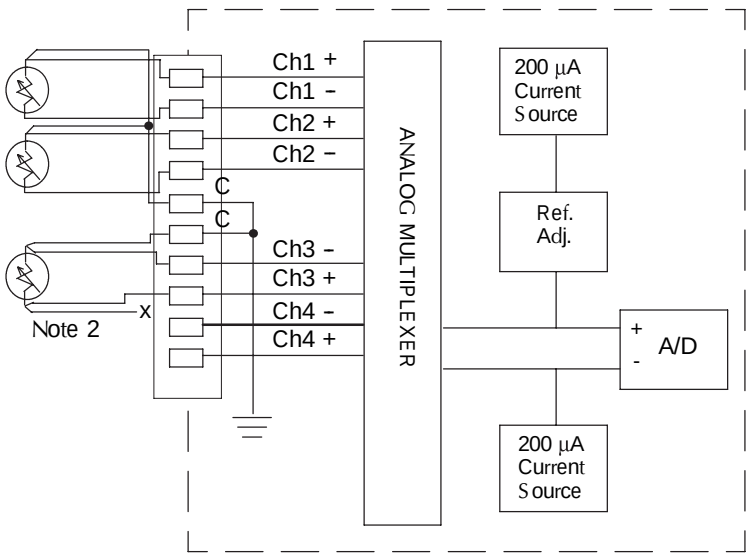
Converter Type	Charge Balancing
Linearity Error	±.05°C maximum, ±.01°C typical
Maximum Inaccuracy	±1°C
PLC Update Rate	4 channel/scan max., 240/250(-1)/D2-260CPUs 1 channel per scan max., 230 CPU
Digital Input Points Required	32 input points (16 binary data bits, 2 channel ID bits, 4 fault bits)
Base Power Required 5VDC	90mA
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Temperature Drift	None (self-calibrating)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

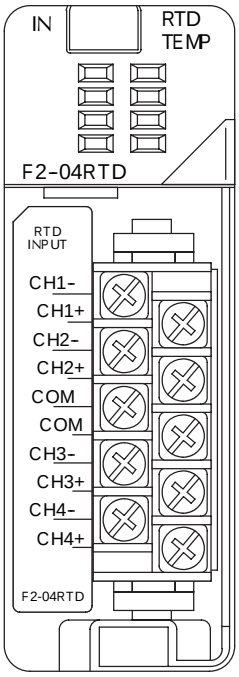
Notes:

1. The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for the third connection.

2. If an RTD sensor has four wires, the plus sense wire should be left unconnected as shown.

Note 1





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TEMPERATURE INPUT MODULES

F2-04THM 4-Channel Thermocouple In <--->	
General Specifications	
Number of Channels	4, differential
Common Mode Range	±5VDC
Common Mode Rejection	90dB min. @ DC, 150dB min. @ 50/60Hz.
Input Impedance	1MΩ
Absolute Maximum Ratings	Fault-protected inputs to ±50 VDC
Accuracy vs. Temperature	±5ppm/°C maximum full scale calibration (including maximum offset change)
PLC Update Rate	4 channels per scan max. D2-240/250(-1)/D2-260 CPU, H2-EBC(-F); 1 chan. per scan max. D2-230 CPU
Digital Input Points Required	32 (X) input points (16 binary data bits, 2 channel ID bits, 4 diagnostic bits)
External Power Supply	60mA maximum, 18 to 26.4VDC
Base Power Required 5VDC	110 mA
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

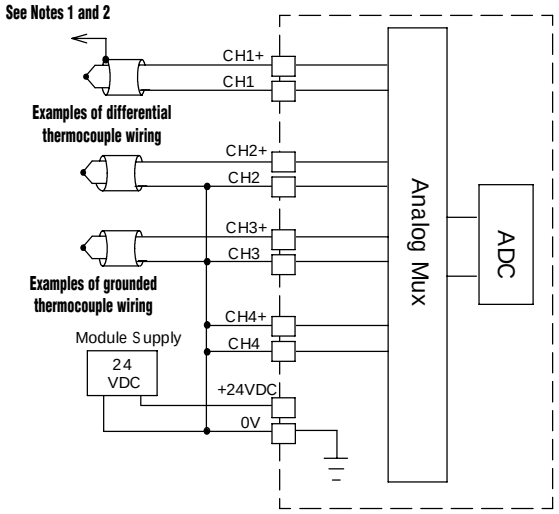
Thermocouple Specifications		
Input Ranges	Type J -190 to 760°C Type E -210 to 1000°C Type K -150 to 1372°C Type R 65 to 1768°C Type S 65 to 1768°C Type T -230 to 400°C Type B 529 to 1820°C Type N -70 to 1300°C Type C 65 to 2320°C	-310 to 1400°F -346 to 1832°F -238 to 2502°F 149 to 3214°F 149 to 3214°F -382 to 752°F 984 to 3308°F -94 to 2372°F 149 to 4208°F
Display Resolution	±0.1°C or ±0.1°F	
Cold Junction Compensation	Automatic	
Conversion Time	100ms per channel	
Warm-Up Time	30 minutes typically ± 1°C repeatability	
Linearity Error (End to End)	±.05°C maximum, ±.01°C typical	
Maximum Inaccuracy	±3°C (excluding thermocouple error)	
Voltage Input Specifications		
Voltage Ranges	0-5V, ±5V, 0-156.25mV, ±156.25mVDC	
Resolution	16 bit (1 in 65535)	
Full Scale Calibration Error (Offset Error Included)	±13 counts typical ±33 maximum	
Offset Calibration Error	±1 count maximum, @ 0V input	
Linearity Error (End to End)	±1 count maximum	
Maximum Inaccuracy	±.02% @ 25°C (77°F)	

Note 1: Terminate shields at the respective signal source.

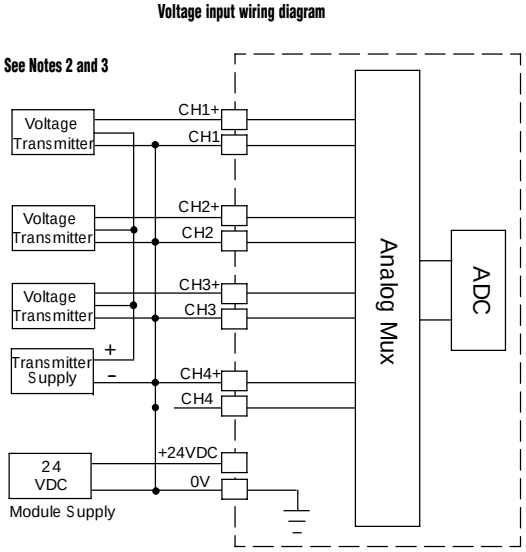
Note 2: Connect unused channels to a common terminal (0V, CH4+, CH4).

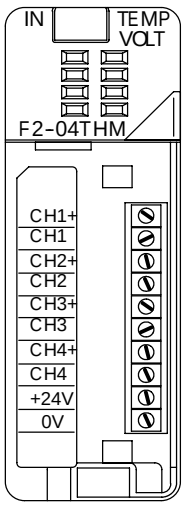
Note 3: When using 0-156mV and 5V ranges, connect (-) or (0) volts terminal to 0V to ensure common mode range acceptance.

Thermocouple input wiring diagram



Voltage input wiring diagram





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Analog Current Output Modules

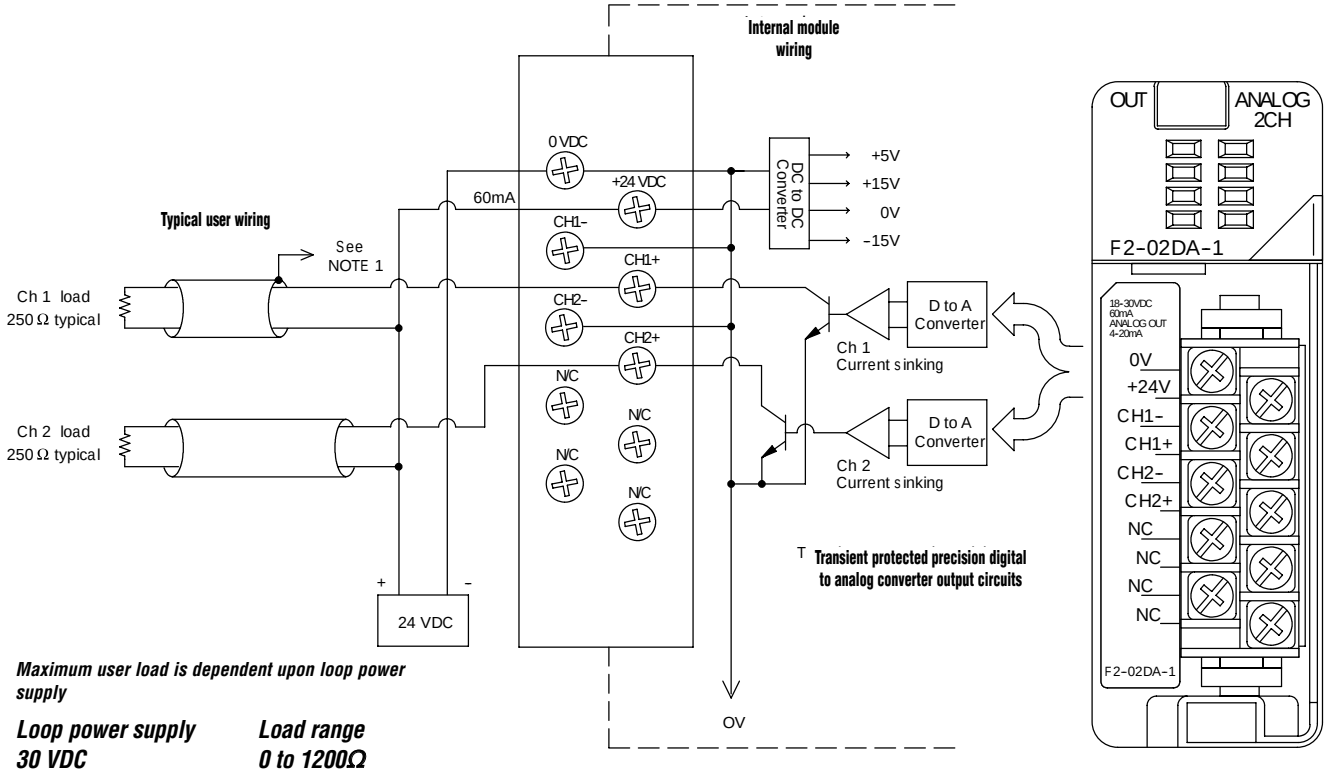
F2-02DA-1 2-Channel 4-20mA Analog Out <--->

This module requires a 24VDC user power supply for operation. See the F2-02DA-1L on the next page if you want to use a 12VDC supply. All other specifications are the same.

Number of Channels	2
Output Ranges	4 to 20mA
Resolution	12 bit (1 in 4096)
Output Type	Single ended, one common
Maximum Loop Supply	30VDC
Peak Output Voltage	40VDC (clamped by transient voltage suppressor)
Load Impedance	0Ω minimum
Maximum Load/Power Supply	620Ω/18V, 910Ω/24V, 1200Ω/30V
PLC Update Rate	1 channel per scan maximum D2-230 CPU 2 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (end to end)	±1 count (±0.025% of full scale) maximum
Conversion Settling Time	100µs maximum (full scale change)
Full Scale Calibration Error (offset error included)	± 5 counts max., 20mA @77ºF (25ºC)
Offset Calibration Error	± 3 counts max., 4mA @ 77ºF (25Cº)
Accuracy vs. Temperature	±50ppm/ºC full scale calibration change (including maximum offset change of 2 counts)
Maximum Inaccuracy	0.1% @ 77ºF (25ºC) 0.3% @ 32º to 140ºF (0º to 60ºC)
Digital Output Points Required	16 (Y) output points (12 binary data bits, 2 channel ID bits)
Base Power Requirement 5VDC	40mA
External Power Supply	18 to 30VDC, 60mA. (add 20 mA for each current loop used)
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4 to 158ºF(-20 to 70ºC)
Relative Humidity	5% to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

NOTE 1: Shields should be connected to the 0V of the module or the 0V of the R/S.
NOTE 2: Unused current outputs should remain open (no connections) for minimum power consumption.



Maximum user load is dependent upon loop power supply

Loop power supply	***Load range***
30 VDC	***0 to 1200Ω***
24 VDC	***0 to 910Ω***
18 VDC	***0 to 620Ω***

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ANALOG CURRENT OUTPUT MODULES

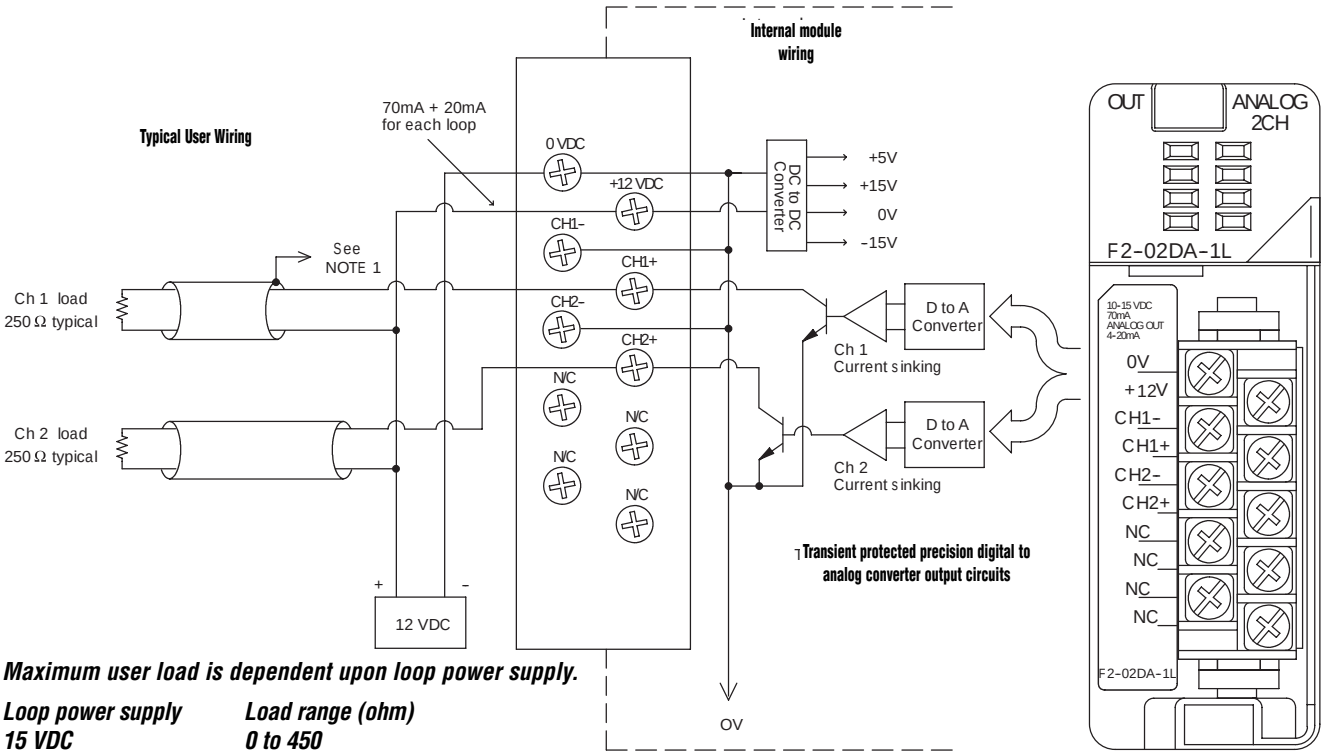
F2-02DA-1L 2-Ch 4-20mA Analog Output <--->	
This module requires a 12 VDC user power supply for operation. See the F2-02DA-1 on the previous page if you want to use a 24VDC supply. All other specifications are the same.	
Number of Channels	2
Output Ranges	4 to 20mA
Resolution	12 bit (1 in 4096)
Output Type	Single ended, 1 common
Peak Output Voltage	40VDC (clamped by transient voltage suppressor)
Load Impedance	0Ω minimum
Maximum Load/ Power Supply	620Ω/18V, 910Ω/24V, 1200Ω/30V
PLC Update Rate	1 channel per scan maximum (D2-230 CPU) 2 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Conversion Settling time	100µs maximum (full scale change)
Full Scale Calibration Error (offset error included)	±5 counts max., 20mA @ 77°F (25°C)
Offset Calibration Error	±3 counts max., 4mA @ 77°F (25°C)

Accuracy vs. Temperature	±50ppm/°C full scale calibration change (including maximum offset change of 2 counts)
Maximum Inaccuracy	+0.1% @ 77°F (25°C) ±0.3% @ 32 to 140°F (0 to 60°C)
Digital Output Points Required	16(Y) output points (12 binary data bits, 2 channel ID bits)
Base Power Required 5VDC	40mA
External Power Supply	10 to 15 VDC, 70 mA (add 20 mA for each current loop used)
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

NOTE 1: Shields should be connected to the 0V of the module or the 0V of the P/S.

NOTE 2: Unused current outputs should remain open (no connections) for minimum power consumption.



Maximum user load is dependent upon loop power supply.

Loop power supply	***Load range (ohm)***
15 VDC	***0 to 450***
12 VDC	***0 to 300***
10 VDC	***0 to 200***

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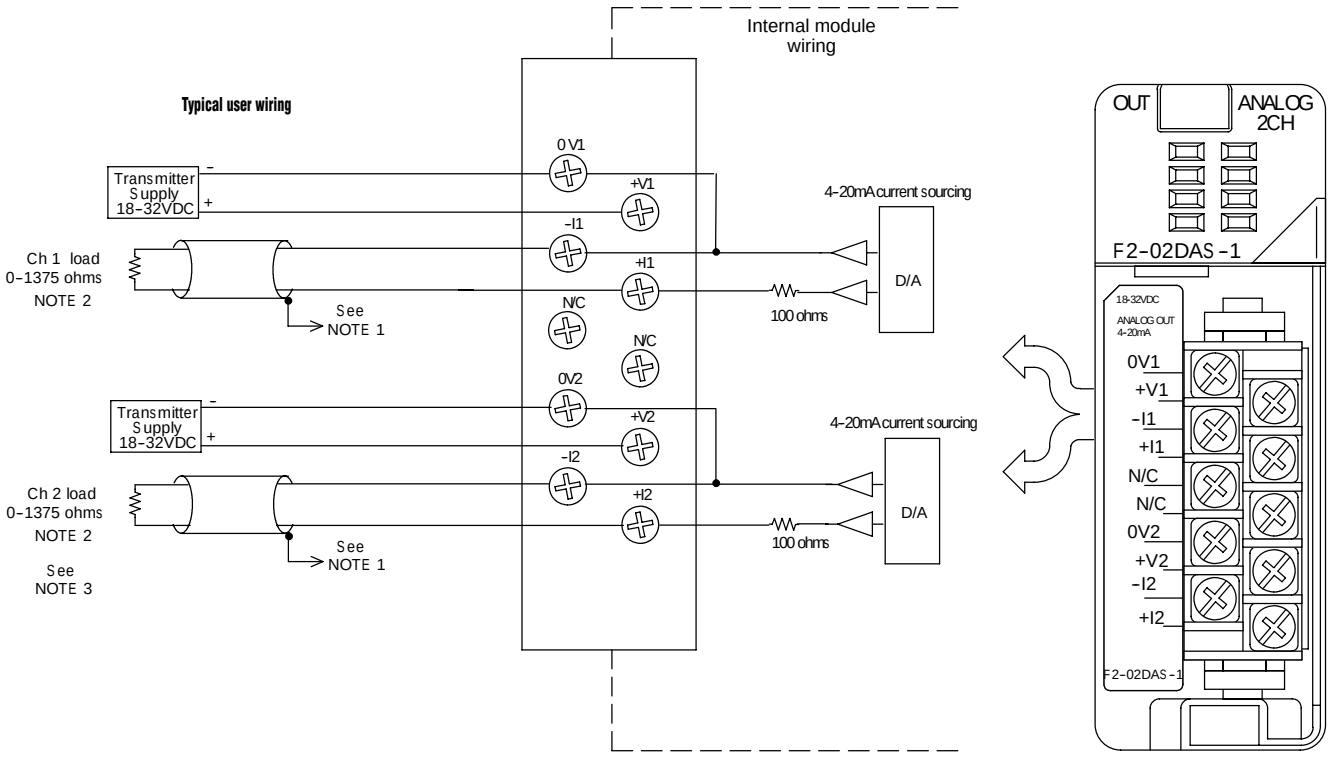
Analog Current Output Modules

F2-02DAS-1 2-Channel 4-20mA Isolated Analog Output <--->	
Number of Channels	2, isolated
Output Ranges	4 to 20mA
Resolution	16 bit (1 in 65536)
Output Type	Current sourcing
Isolation Voltage	±750V continuous, channel to channel, channel to logic
Loop supply	18V-32VDC
External Power Supply	18-32VDC @ 50mA per channel
Output loop Compliance	Vin - 2.5V
Load Impedance	0-1375Ω (@32V)
Maximum Load/ Power Supply	375Ω/12V, 975Ω/24V, 1375Ω/32V
PLC Update Rate	1 channel per scan maximum (D2-230 CPU) 2 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Digital Output Points Required	32 (Y) output points (16 binary data bits, 2 channel ID bits, 1 output enable bit)

Base Power Requirement 5VDC	100mA
Linearity Error (end to end)	±10 count (±0.015% of full scale) maximum
Conversion Settling time	3ms to 0.1% of full scale
Gain Calibration Error	±32 counts (±0.05%)
Offset Calibration Error	±13 counts (±0.02%)
Output Drift	50 ppm/°C
Maximum Inaccuracy	0.07% @ 25°C (77°F) 0.18% 0 to 60°C (32° to 140°F)
Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Relative Humidity	5 to 95% (non-condensing)
Environmental air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 65536).

NOTE 1: Shields should be connected to the 0V terminal of the module.
NOTE 2: Load must be within compliance voltage.
NOTE 3: For non-isolated outputs, connect all 0V's together (0V1…0V2) and connect all +V's together (+V1…+V2).



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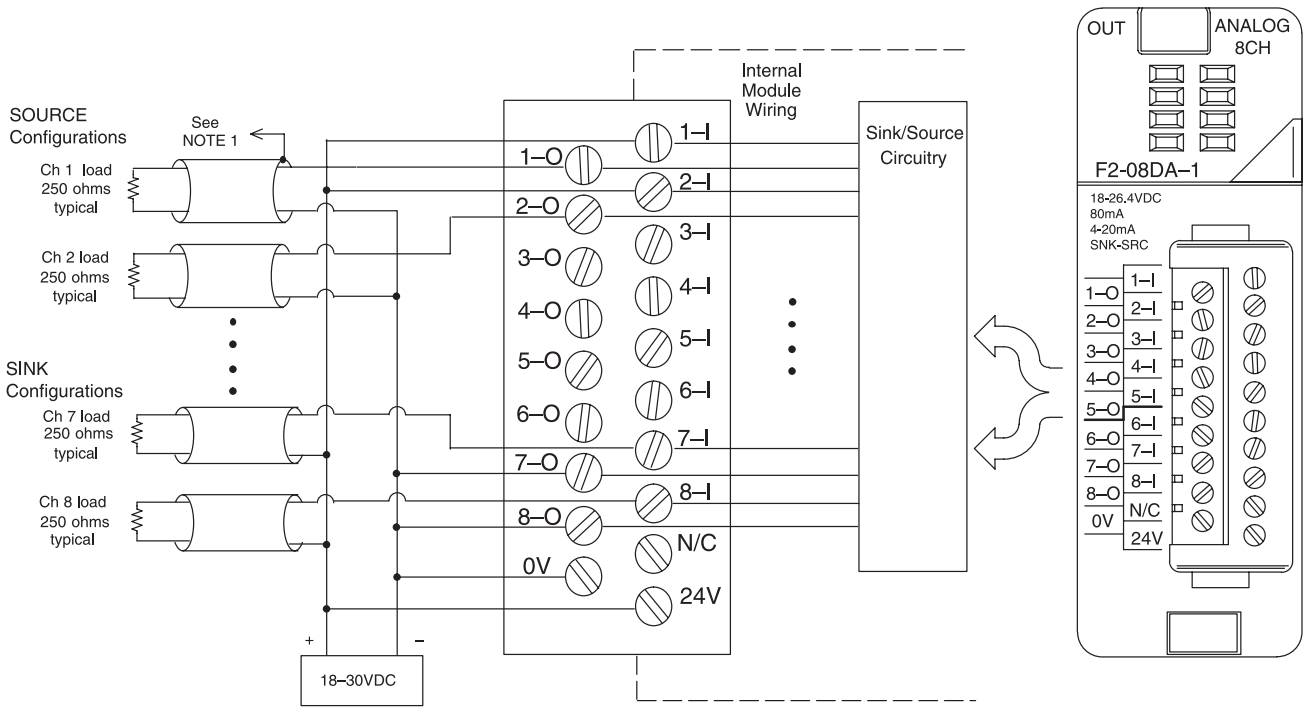
ANALOG CURRENT OUTPUT MODULES

F2-08DA-1 8-Channel 4-20mA Analog Out <--->	
Number of Channels	8, single-ended
Output Ranges	4 to 20mA
Resolution	12 bit (1 in 4096)
Output Type	Current sinking or current sourcing
Maximum Loop Supply	30VDC
Source Load	0-400Ω @ 18-30VDC
Sink Load	0-600Ω/18V, 0-900Ω/24V, 0-1200Ω/30V
Total Load (sink + source)	600Ω/18V, 900Ω/24V, 1200Ω/30V
PLC Update Rate	1 channel per scan maximum (D2-230 CPU) 8 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (end to end)	±2 count (±0.050% of full scale) maximum
Conversion Settling Time	400µs maximum (full scale change)
Full Scale Calibration Error	± 12 counts max. sinking @ any load ± 12 counts max. sourcing @ 125Ω load ± 18 counts max. sourcing @ 250Ω load ± 26 counts max. sourcing @ 400Ω load
Offset Calibration Error	± 9 counts max. sinking @ any load ± 9 counts max. sourcing @ 125Ω load ± 11 counts max. sourcing @ 250Ω load ± 13 counts max. sourcing @ 400Ω load
Max. Full Scale Inaccuracy @ 60°C	0.5% sinking (any load) sinking & sourcing @ 125Ω load 0.64% sourcing @ 250Ω load 0.83% sourcing @ 400Ω load
Max. Full Scale Inaccuracy @ 25°C *(Incudes all errors and temp drift)*	0.3% sinking (any load) sinking & sourcing @ 125Ω load 0.44% sourcing @ 250Ω load 0.63% sourcing @ 400Ω load

Digital Output Points Required	16 (Y) output points (12 binary data bits, 3 channel ID bits, 1 output enable bit)
Base Power Requirement 5VDC	30mA
External Power Supply	18 to 30VDC, 50mA., class 2 (add 20 mA for each current loop used)
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4 to 158°F(-20 to 70°C)
Relative Humidity	5% to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

NOTE 1: Shields should be connected to the 0V of the module.



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Analog Voltage Output Modules

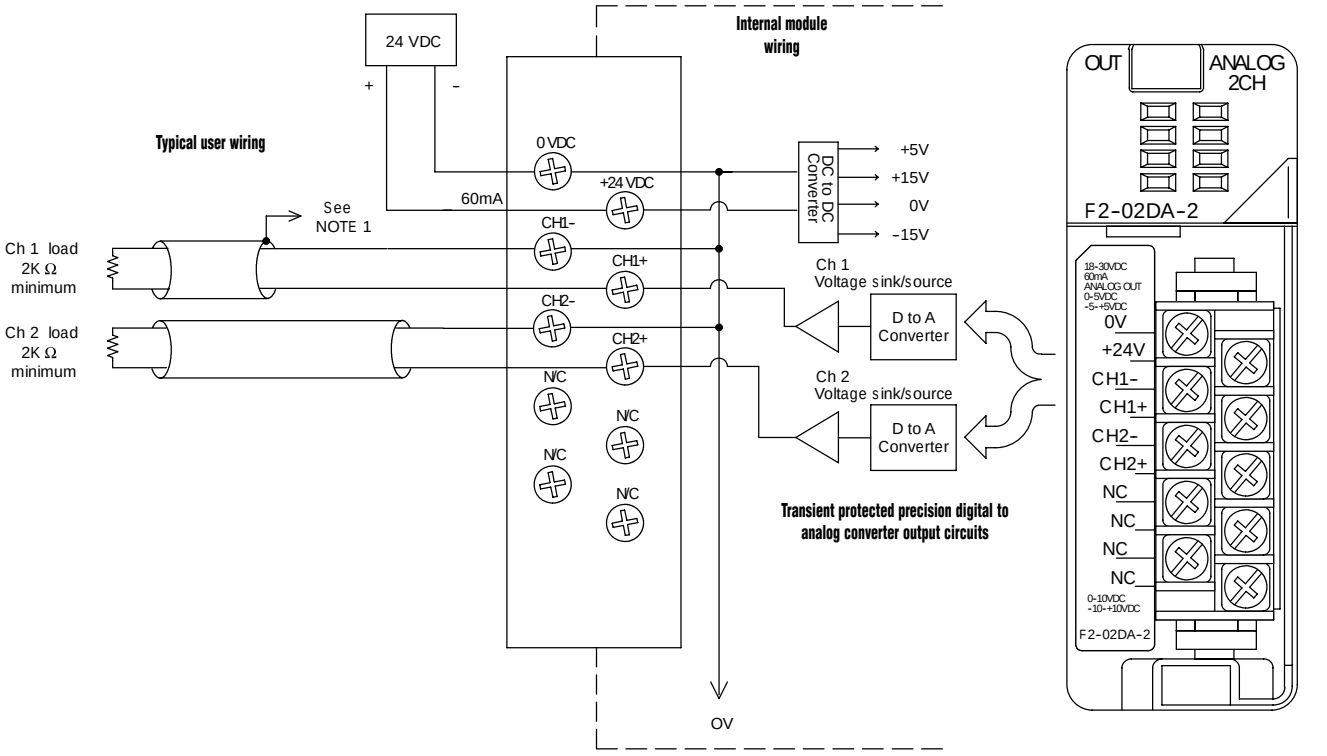
F2-02DA-2 2-Channel Voltage Analog Out <--->	
This module requires a 24VDC user power supply for operation. See the F2-02DA-2L on the next page if you want to use a 12VDC supply. All other specifications are the same.	
Number of Channels	2
Output Ranges	0 to 5V, 0 to 10V, ±5V, ±10V
Resolution	12 bit (1 in 4096)
Output Type	Single ended, 1 common
Peak Output Voltage	15VDC (clamped by transient voltage suppressor)
Load Impedance	2000Ω minimum
Load Capacitance	.01µF maximum
PLC Update Rate	1 channel per scan maximum D2-230 CPU 2 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Conversion Settling Time	5µs maximum (full scale change)
Full Scale Calibration Error (offset error included)	±12 counts max. unipolar @ 77ºF (25ºC) ±16 counts max. bipolar @ 77ºF (25ºC)
Offset Calibration Error	±3 counts max., unipolar @ 77ºF (25ºC) ±8 counts max., bipolar @ 77ºF (25ºC)

Accuracy vs. Temperature	±50ppm/ºC full scale calibration change (including maximum offset change of 2 counts)
Maximum Inaccuracy	+0.3% unipolar ranges @ 77ºF (25ºC) ±0.45% unipolar ranges >77ºF (25ºC) ±0.4% bipolar ranges @77ºF (25ºC) ±0.55% bipolar ranges >77ºF (25ºC)
Digital Output Points Required	16 (Y) output points (12 binary data bits, 2 channel ID bits)
Base Power Required 5VDC	40mA
External Power Supply	18 to 30 VDC, 60mA (outputs fully loaded)
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4º to 158ºF (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

NOTE 1: Shields should be connected to the 0V of the module or the 0V of the R/S.

NOTE 2: Unused voltage outputs should remain open (no connections) for minimum power consumption.



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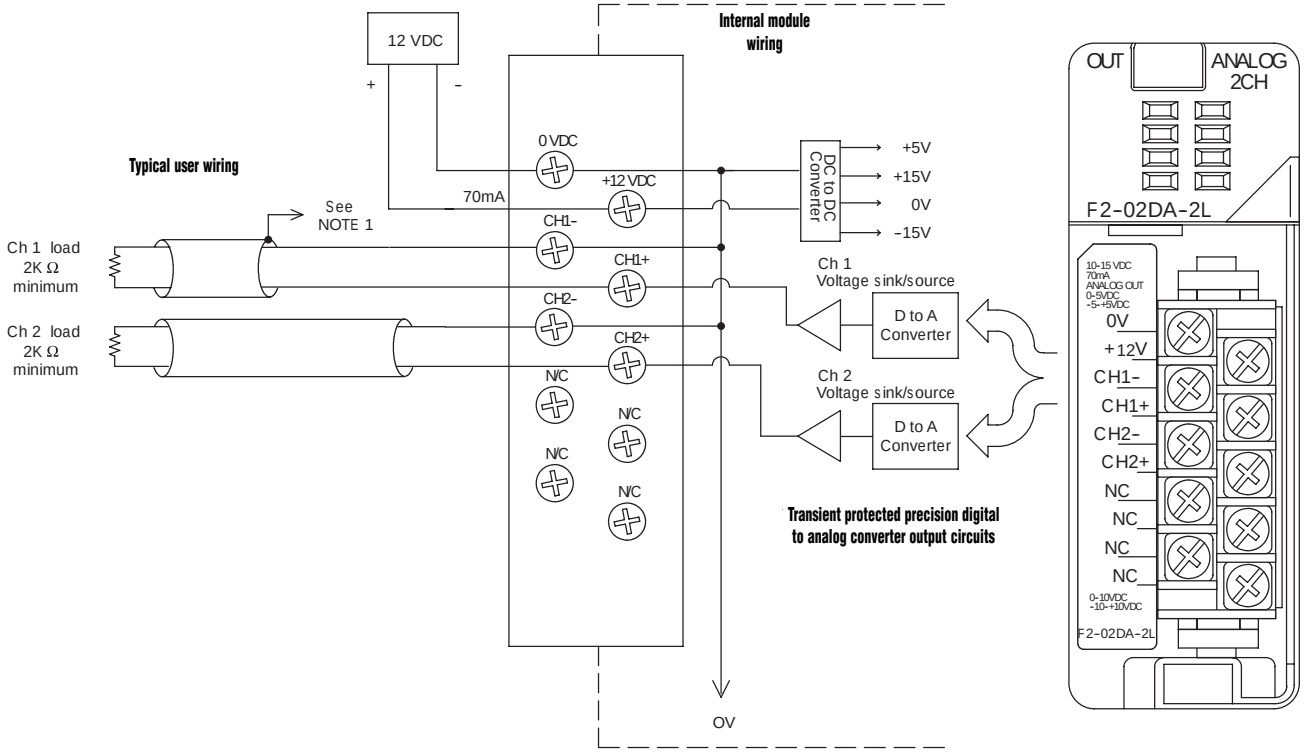
ANALOG VOLTAGE OUTPUT MODULES

F2-02DA-2L 2-Ch. Voltage Analog Out <--->	
This module requires a 12 VDC user power supply for operation. See the F2-02DA-2 on the previous page if you want to use a 24VDC supply. All other specifications are the same.	
Number of Channels	2
Output Ranges	0 to 5V, 0 to 10V, ±5V, ±10V
Resolution	12 bit (1 in 4096)
Output Type	Single ended, 1 common
Peak output voltage	15VDC (clamped by transient voltage suppressor)
Load Impedance	2000Ω minimum
Load Capacitance	.01µF maximum
PLC Update Rate	1 channel per scan maximum (D2-230 CPU) 2 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Conversion Settling Time	5µs maximum (full scale change)
Full Scale Calibration Error (offset error not included)	±12 counts max. unipolar @ 77ºF (25ºC) ±16 counts max. bipolar @ 77ºF (25ºC)
Offset Calibration Error	±3 counts max., unipolar @ 77ºF (25ºC) ±8 counts max., bipolar @ 77ºF (25ºC)

Accuracy vs. Temperature	±50ppm/ºC full scale calibration change (including maximum offset change of 2 counts)
Maximum Inaccuracy	+0.3% unipolar ranges @ 77ºF (25ºC) ±0.45% unipolar ranges >77ºF (25ºC) ±0.4% bipolar ranges @77ºF (25ºC) ±0.55% bipolar ranges >77ºF (25ºC)
Digital Output Points Required	16 (Y) output points (12 binary data bits, 2 channel ID bits)
Base Power Requirement 5VDC	40mA
External Power Supply	10 to 15VDC, 70mA (outputs fully loaded)
Operating Temperature	32º to 140ºF (0º to 60ºC)
Storage Temperature	-4º to 158ºF (-20º to 70ºC)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

NOTE 1: Shields should be connected to the 0V of the module or the 0V of the P/S.
NOTE 2: Unused current outputs should remain open (no connections) for minimum power consumption.



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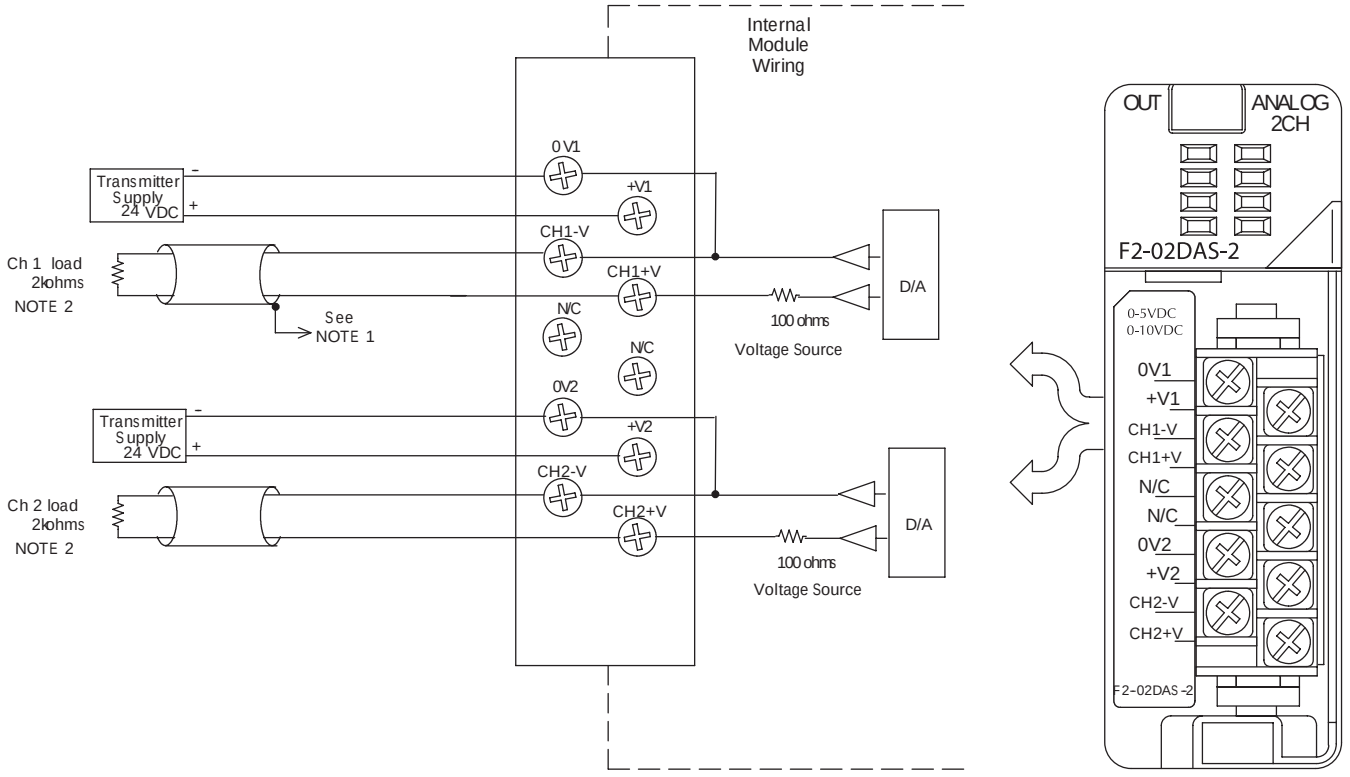
Analog Voltage Output Modules

F2-02DAS-2 2-Channel 0-5V, 0-10V Isolated Analog Output <--->	
Number of Channels	2, isolated
Output Ranges	0-5V, 0-10V
Resolution	16 bit (1 in 65536)
Isolation Voltage	±750V continuous, channel to channel, channel to logic
External Power Supply	21.6-26.4 VDC @ 60mA per channel
Load Impedance	2KΩ min
PLC Update Rate	1 channel per scan maximum (D2-230 CPU) 2 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Digital Output Points Required	32 (Y) output points (16 binary data bits, 2 channel ID bits)

Base Power Requirement	60mA
Linearity Error (end to end)	±10 count (±0.015% of full scale) maximum
Conversion Settling Time	3ms to 0.1% of full scale
Gain Calibration Error	±32 counts (±0.05%)
Offset Calibration Error	±13 counts (±0.02%)
Output Drift	50 ppm/°C
Maximum Inaccuracy	0.07% @ 25°C (77°F) 0.18% 0 to 60°C (32° to 140°F)
Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304



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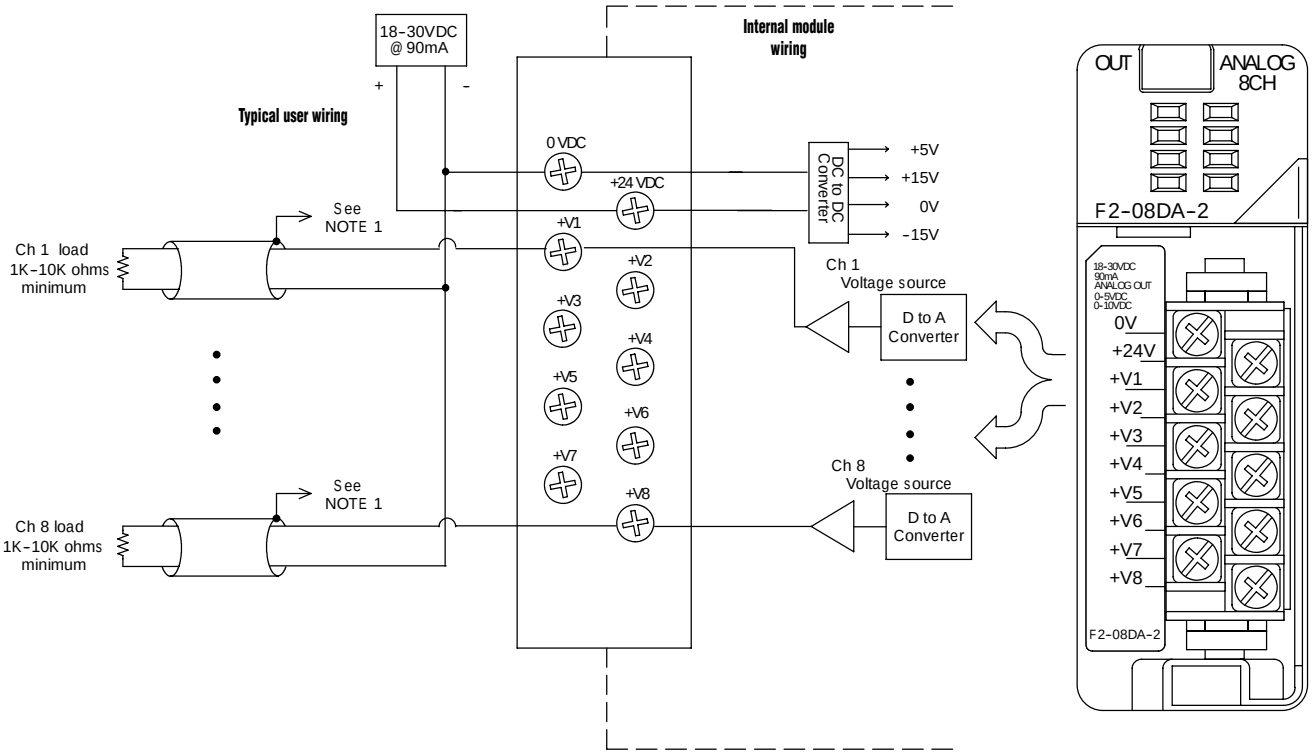
ANALOG VOLTAGE OUTPUT MODULES

F2-08DA-2 8-Channel Voltage Analog Out <--->	
Number of Channels	8, single-ended, 1 common
Output Ranges	0 to 5V, 0 to 10V
Resolution	12 bit (1 in 4096)
Peak Output Voltage	15VDC (clamped by transient voltage suppressor)
Load Impedance	1K -10KΩ
Load Capacitance	.01µF maximum
PLC Update Rate	1 channel per scan maximum (D2-230 CPU) 8 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs)
Linearity Error (end to end)	±1 count (±0.025% of full scale) maximum
Conversion Settling time	400µs maximum (full scale change) 4.5ms to 9ms for digital out to Analog out
Full Scale Calibration Error (offset error included)	±12 counts max. unipolar @ 25°C (77°F)
Offset Calibration Error	±3 counts max., unipolar @ 25°C (77°F)

Accuracy vs. Temperature	±57ppm/°C full scale calibration change (including maximum offset change of 2 counts)
Maximum Inaccuracy	0.45% to 60°C (32° to 140°F)
Digital Output Points Required	16 (Y) output points (12 binary data bits, 3 channel ID bits, 1 output enable bit)
Base Power Required 5VDC	60mA
External Power Supply	21.6-26.4VDC, 140mA (outputs fully loaded)
Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	-20° to 70°C (-4° to 158°F)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

NOTE 1: Shields should be connected to the 0V of the module.



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Analog In/Out Combination Module

F2-4AD2DA 4-Channel Analog Input / 2-Channel Analog Output <--->	
Number of Input Channels	4, single-ended (1 common)
Number of Output Channels	2, single-ended (1 common)
Ranges	4 to 20mA current (current sinking)
Resolution	12 bit (1 in 4096)
Peak Withstanding Voltage	75VDC, current outputs
Maximum Continuous Overload	-40 to +40mA, each current output
Input Impedance	250Ω, ±0.1%, 1/2W, 25ppm/°C current input resistance
External Load Resistance	0Ω minimum, current outputs
Maximum Loop Supply	30VDC
Recommended Fuse	0.032A, series 217 fast-acting, current inputs
Maximum Load/Power Supply	910Ω/24V, current outputs 620Ω/18V, 1200Ω/30V
Active Low-pass Filter	-3dB at 20Hz, 2 poles (-12 dB per octave)
Linearity Error (best fit)	±1 count (±0.025% of full scale) maximum
Output Settling Time	100µs maximum (full scale change)

Accuracy vs. Temperature	±50ppm/°C full scale calibration change (including maximum offset change)
Maximum Inaccuracy	±0.1% @ 77°F (25°C ±0.3% @ 32 to 140°F (0 to 60°C)
Digital Input and Output Points Required	16 (X) input points (12 binary data bits, 2 channel ID bits, 2 diagnostic bits) 16 (Y) output points (12 binary data bits, 2 channel enable bits)
PLC Update Rate	4 channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs) 2 output channels per scan maximum (D2-240, D2-250(-1) and D2-260 CPUs) 1 input and 1 output channel per scan maximum (D2-230 CPU)
Base Power Required 5VDC	90mA
External Power Supply Requirement	18-26.4VDC @ 80mA 20mA per loop
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

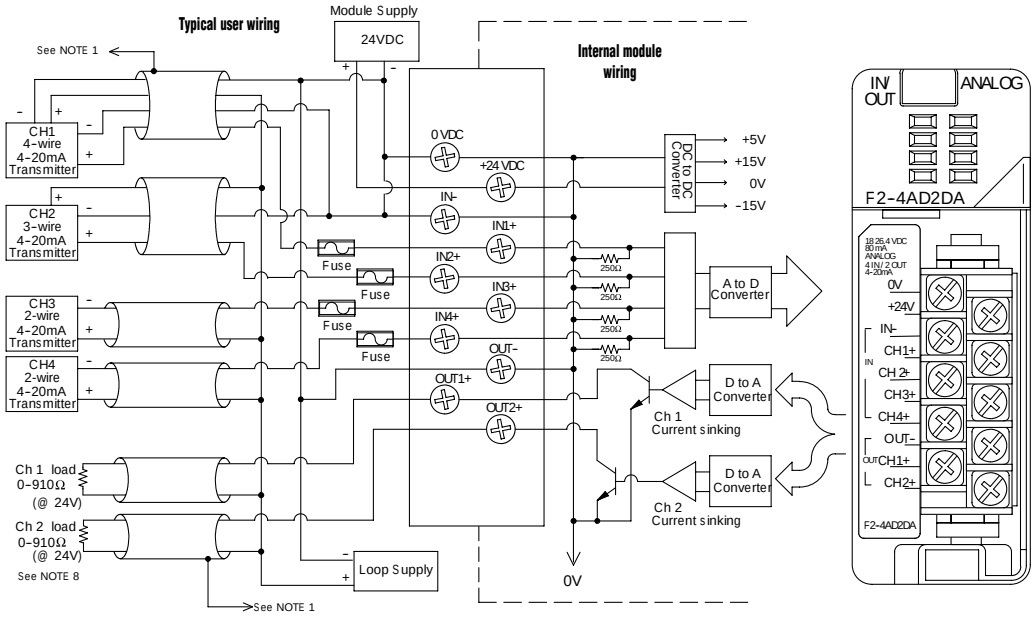
One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be connected at their respective signal source.
Note 2: Unused channel should remain open for minimum power consumption.
Note 3: More than one external power supply can be used provided the power supply commons are connected.
Note 4: A Series 217, 0.032A fast-acting fuse is recommended for 4-20mA current input loops.
Note 5: If the power supply common of an external power supply is not connected to 0VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20mA transmitter types are:
2 or 3 wire: isolation between Input signal and power supply
4 wire: Isolation between input signal, power supply, and 4-20mA output

Note 6: If an analog channel is connected backwards, then erroneous data values will be returned for that channel.

Note 7: To avoid small errors due to terminal block losses, connect 0VDC, IN-, and OUT- on the terminal block as shown. The module's internal connection alone of these nodes is not sufficient to permit module performance up to the accuracy specifications.

Note 8: Choose an output transducer resistance according to the maximum load/power listed in the Output Specifications.



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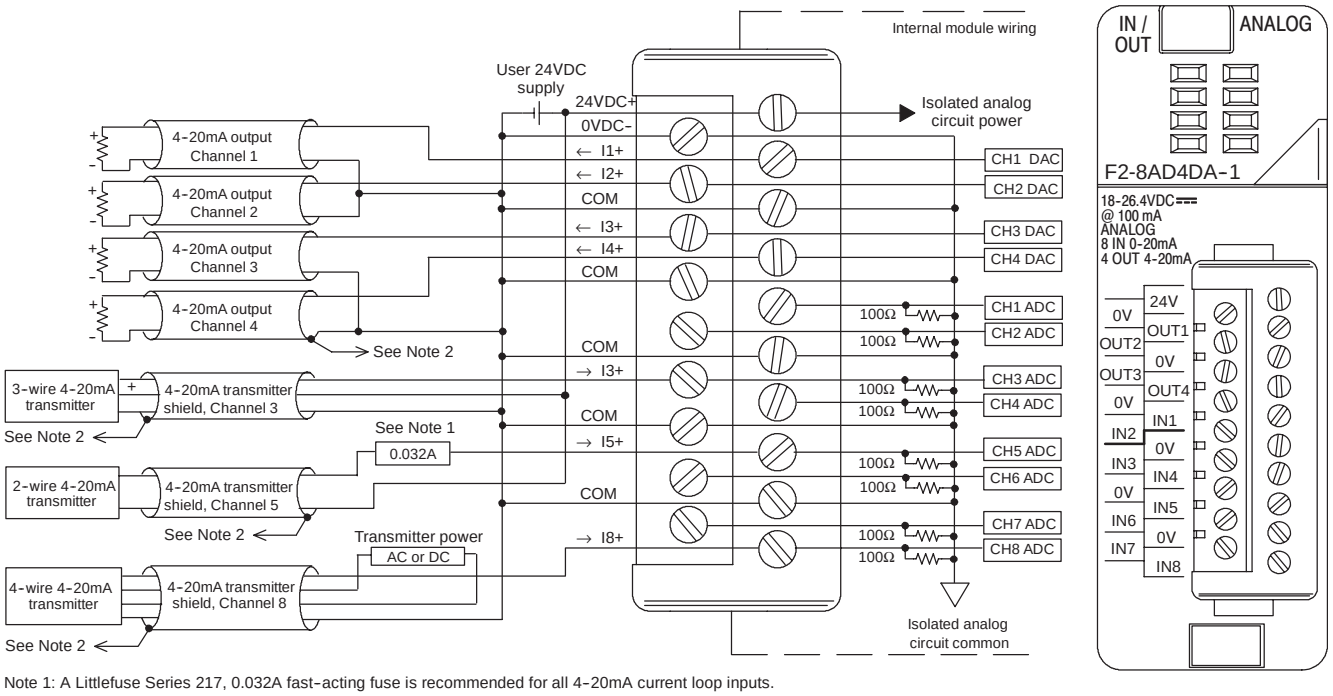
ANALOG IN/OUT COMBINATION MODULE

NOT SUPPORTED IN D2-230 AND D2-240 CPUS.

F2-8AD4DA-1 8-Channel Analog Current Input / 4-Channel Analog Current Output <--->	
Inputs per module	8, single ended (one common)
Input Range	0 to 20 mA
Resolution	12, 14, 16-bit selectable
External DC Power Required	100 mA @ 18-26.4 VDC
Max. Continuous Overload	±45mA
Input Impedance	100Ω 0.1% 1/4W
Filter Characteristics	Active low pass, -3dB @ 80Hz
Conversion Time	12-bit = 1.25 ms per channel 14-bit = 6 ms per channel 16-bit = 25 ms per channel
Conversion Method	Over sampling successive approximation
Accuracy vs. Temperature	±25 ppm / °C Max.
Max. Inaccuracy	0.1% of range
Linearity Error (End to End)	12-bit = ±2 count max. (±0.06% of range) 14-bit = ±10 count max. (±0.06% of range) 16-bit = ±20 count max. (±0.06% of range) Monotonic with no missing codes
Full Scale Calibration Error (not incl. offset error)	±0.07% of range max.
Offset Calibration Error	±0.03% of range max.
Rec. Fuse (external)	0.032A, Littelfuse Series 217 fast-acting
Base Power Required 5VDC	35mA

Outputs per module	4
Output Range	4 to 20 mA
Resolution	16-bit, 0.244 mA/bit
Output Type	Current sourcing at 20mA max.
Load Impedance	0-750Ω
Max. Inaccuracy	0.25% of range
Max. Full Scale Calibration Error (not incl. offset error)	±0.175% of range max.
Max. Offset Calibration Error	±0.1% of range max.
Accuracy vs. Temperature	±25 ppm/ °C max. full scale calibration change (± 0.0025% of range / °C)
Max. Crosstalk at DC, 50/60Hz	-70 dB, 1 LSB
Linearity Error (End to End)	±1 count max. (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±1 LSB after 10 min. warm-up typical
Output Ripple	0.005% of full scale
Output Settling Time	0.5 ms max., 5 µs min. (full scale change)
Max. Continuous Overload	Outputs open circuit protected
Type of Output Protection	Electronically current limited to 20 mA or less
Output signal at power-up and power-down	4 mA



Note 1: A Littlefuse Series 217, 0.032A fast-acting fuse is recommended for all 4-20mA current loop inputs.

Note 2: Connect shields to the 0V of the module; do not connect both ends of shield.

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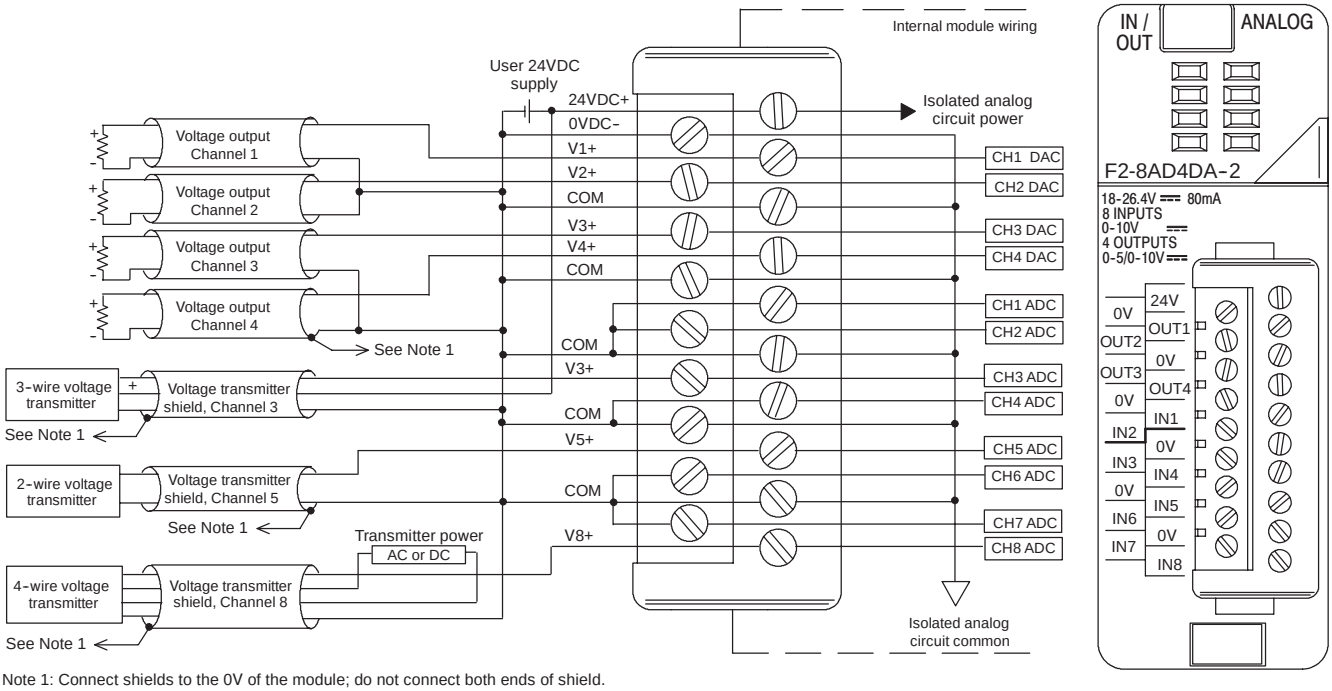
Analog In/Out Combination Module

Not supported in D2-230 and D2-240 CPUs.

F2-8AD4DA-2 8-Channel Analog Voltage Input / 4-Channel Analog Voltage Output <--->	
Inputs per module	8, single ended (one common)
Input Range	0 to 10V
Resolution	12, 14, 16-bit selectable
External DC Power Required	80 mA @ 18-26.4VDC
Max. Continuous Overload	±100V
Input Impedance	>10MΩ
Filter Characteristics	Active low pass, -3dB @ 80Hz
Conversion Time	12-bit = 1.25 ms per channel 14-bit = 6 ms per channel 16-bit = 25 ms per channel
Conversion Method	Over sampling successive approximation
Accuracy vs. Temperature	±50 ppm / °C Max.
Max. Inaccuracy	0.1% of range
Linearity Error (End to End)	12-bit = ±1 count max. (±0.025% of range) 14-bit = ±4 count max. (±0.025% of range) 16-bit = ±16 count max. (±0.025% of range) Monotonic with no missing codes
Full Scale Calibration Error (not incl. offset error)	±0.075% of range max.
Offset Calibration Error	±0.025% of range max.
Base Power Required 5VDC	35mA

Outputs per module	4
Output Range	0 - 5V, 0 - 10V
Resolution	0 to 5V at 15-bit, 0 to10V at 16-bit, 152µV/bit
Output Type	Voltage sourcing/sinking at 10mA max.
Load Impedance	>1000Ω
Max. Inaccuracy	0.15% of range
Max. Full Scale Calibration Error (not incl. offset error)	±0.075% of range max.
Max. Offset Calibration Error	±0.025% of range max.
Accuracy vs. Temperature	±50 ppm/ °C max. full scale calibration change (± 0.005% of range / °C)
Max. Crosstalk at DC, 50/60Hz	-70 dB, 1 LSB
Linearity Error (End to End)	±1 count max. (±0.025% of full scale) Monotonic with no missing codes
Output Stability and Repeatability	±1 LSB after 10 min. warm-up typical
Output Ripple	0.005% of full scale
Output Settling Time	0.5 ms max., 5µs min. (full scale change)
Max. Continuous Overload	Outputs current limited to 15 mA typical
Type of Output Protection	1 VDC peak output voltage (clamped by transient voltage suppressor)
Output signal at power-up and power-down	0V



Note 1: Connect shields to the 0V of the module; do not connect both ends of shield.

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DL205 Instruction Set

Bodean Instructions

Store (STR)
Begins a new rung or an additional branch in a rung with a normally open contact.

Store Not (STRN)
Begins a new rung or an additional branch in a rung with a normally closed contact.

Store Bit-of-Word (STRB)
D2-250-1, D2-260 only. Begins a new rung or an additional branch in a rung with a normally open contact.

Store Not Bit-of-Word (STRNB)
D2-250-1, D2-260 only. Begins a new wrung or an additional branch in a rung with a normally closed contact.

Or (OR)
Logically ors a normally open contact in parallel with another contact in a rung.

Or Not (ORN)
Logically ors a normally closed contact in parallel with another contact in a rung.

Or Bit-of-Word (ORB)
D2-250-1, D2-260 only. Ors a normally open contact in parallel with another contact in a rung.

Or Not Bit-of-Word (ORNB)
D2-250-1, D2-260 only. Ors a normally closed contact in parallel with another contact in a rung.

And (AND)
Logically ands a normally open contact in series with another contact in a rung.

And Not (ANDN)
Logically ands a normally closed contact in series with another contact in a rung

And Bit-of-Word (ANDB)
D2-250-1, D2-260 only. Ands a normally open contact in series with another contact in a rung.

And Not Bit-of-Word (ANDNB)
D2-250-1, D2-260 only. Ands a normally closed contact in series with another contact in a rung.

And Store (AND STR)
Logically ands two branches of a rung in series.

Or Store (OR STR)
Logically ors two branches of a rung in parallel.

Out (OUT)
Reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified image register point or memory location.

Or Out(OR OUT)
Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program.

Out Bit-of-Word (OUTB)
D2-250-1, D2-260 only. Reflects status of the rung (on/off) and outputs the discrete (on/off) state to the specified bit in the referenced memory location.

Not (NOT)
D2-250-1, D2-260 only. Inverts the status of the rung at the point of the instruction.

Positive differential (PD)
One-shot output coil. When the input logic produces an off to on transition, the output will energize for one CPU scan.

Store Positive Differential (STRPD)
D2-250-1, D2-260 only. Leading edge triggered one-shot contact. When the corresponding memory location transitions from low to high, the contact comes on for one CPU scan.

Store Negative Differential (STRND)
D2-250-1, D2-260 only. Trailing edge triggered one-shot contact. When the corresponding memory location transitions from high to low, the contact comes on for one CPU scan.

Or Positive Differential (ORPD)
D2-250-1, D2-260 only. Logically ors a leading edge triggered one-shot contact in parallel with another contact in a rung.

Or Negative Differential (ORND)
D2-250-1, D2-260 only. Logically ors a trailing edge triggered one-shot contact in parallel with another contact in a rung.

And Positive Differential (ANDPD)
D2-250-1, D2-260 only. Logically ands a leading edge triggered one-shot contact in series with another contact in a rung.

And Negative Differential (ANDND)
D2-250-1, D2-260 only. Logically ands a trailing edge triggered one-shot contact in series with another contact in a rung.

Set (SET)
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) OFF that were set ON with the set instruction.

Reset (RST)
An output that resets a point or a range of points.

Set Bit-of-Word (SETB)
D2-250-1, D2-260 only. Sets or turns on a bit in a V memory location.

Reset Bit-of-Word (RSTB)
D2-250-1, D2-260 only. Resets or turns off a bit in a V memory location.

Pause outputs (PAUSE)
Disables the update for a range of specified output points.

Comparative Bodean Instructions

Store if Equal (STRE)
Begins a new rung or additional branch in a rung with a normally open comparative contact. The contact will be on when A = B.

Store if Not Equal (STRNE)
Begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when A is not equal to B.

Or if Equal (ORE)
Connects a normally open comparative contact in parallel with another contact. The contact will be on when A = B.

Or if Not Equal (ORNE)
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A is not equal to B.

And if Equal (ANDE)
Connects a normally open comparative contact in series with another contact. The contact will be on when A = B.

And if Not Equal (ANDNE)
Connects a normally closed comparative contact in series with another contact. The contact will be on when A is not equal to B.

Store (STR)
Begins a new rung or additional branch in a rung with a normally open comparative contact. The will be on when A ≥ B.

Store Not (STRN)
Begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when A < B.

Or (OR)
connects a normally open comparative contact in parallel with another contact. The contact will be on when A ≥ B.

Or Not (ORN)
connects a normally open comparative contact in parallel with another contact. The contact will be on when A < B.

And (AND)
Connects a normally open comparative contact in series with another contact. The contact will be on when A ≥ B.

And Not < (ANDN)
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A < B.

Immediate Instructions

Store Immediate (STRI)
Begins a rung/branch of logic with a normally open contact. The contact will be updated with the current input field status when processed in the program scan.

Store Not Immediate (STRNI)
Begins a rung/branch of logic with a normally closed contact. The contact will be updated with the current input field status when processed in the program scan.

Or Immediate (ORI)
Connects a normally open contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.

Or Not Immediate (ORNI)
Connects a normally closed contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.

And Immediate (ANDI)
Connects a normally open contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.

And Not Immediate (ANDNI)
Connects a normally closed contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.

Out Immediate (OUTI)
Reflects the status of the rung. The output field device status is updated when the instruction is processed in the program scan.

Or Out Immediate (OROUTI)
Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program. The output field device status is updated when the instruction is processed in the program scan.

Out Immediate Formatted (OUTIF)
D2-260 only. Outputs the contents of the accumulator to a specified number of consecutive outputs The output field devices are updated when the instruction is processed by the program scan.

Set Immediate (SETI)
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) off that were set. The output field device status is updated when the instruction is processed in the program scan.

Reset Immediate (RSTI)
an output that resets a point or a range of points. The output field device status is updated when the instruction is processed in the program scan.

Load Immediate (LDI)
D2-260 only. Loads the accumulator with the contents of a specified 16-bit V-memory location. The status for each bit of the specified V-memory location is loaded into the accumulator. Typically used for input module V-memory addresses. Allows you to specify the V-location instead of the X location and the number of points as with the LDIF.

Load Immediate Formatted (LDIF)
D2-260 only. Loads the accumulator with a specified number of consecutive inputs. The field device status for the specified inputs points is loaded into the accumulator when the instruction is executed

Timer, Counter, and Shift Register Instructions

Timer (TMR)
Single input incrementing timer with 0.1 second resolution (0-999.9 seconds)

Fast Timer (TMRF)
Single input incrementing timer with 0.01 second resolution (0-99.99 seconds)

Accumulating Timer (TMRA)
Two input incrementing timer with 0.1 second resolution (0-9,999,999.9 sec.). Time and enable/reset inputs control the timer.

Accumulating Fast Timer (TMRAF)
Two input incrementing timer with 0.1 second resolution (0-999,999.99 sec.). Time and enable/reset inputs control the timer

Counter (CNT)
Two input incrementing counter (0-9999). Count and reset inputs control the counter.

Stage Counter (SGCNT)
Single input incrementing counter (0-9999) RST instruction must be used to reset count.

Up Down Counter (UDC)
Three input counter (0-99,999,999). Up, down and reset inputs control the counter.

Shift Register (SR)
Shifts data through a range of control relays with each clock pulse.The data clock and reset inputs control the shift register.

Accumulator/Stack Load and Output Data

Load (LD)
Loads a 16-bit word into the lower 16 bits of the accumulator/stack.

Load Double (LDD)
Loads a 32-bit word into the accumulator/stack.

Load Formatted (LDF)
Loads the accumulator with a specified number of consecutive discrete memory bits.

Load Address (LDA)
Loads the accumulator with the HEX value for an octal constant (address).

Load Accumulator Indexed (LDX)
Specifies a source address (V memory) which will be offset by the value in the first stack location.

Load Accumulator Indexed from Data Constants (LDSX)
D2-240, D2-250-1, D2-260 only. Specifies a Data Label Area (DLBL) where numerical or ASCII constants are stored.

Out (OUT)
Copies the value in the lower 16 bits of the accumulator to a specified V memory location.

Out Double (OUTD)
Copies the value in the accumulator to two consecutive V memory locations.

Out Formatted (OUTF)
Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.

Out Least (OUTL)
D2-260 only. Copies the value in the lower 8-bits of the accumulator to the lower 8-bits of a specified V-memory location

Out Most (OUTM)
D2-260 only. Copies the value in the upper 8-bits of the lower accumulator word (1st 16 bits) to the upper 8 bits of a specified V-memory location

Output indexed (OUTX)
D2-250-1, D2-260 only. Copies a 16-bit value from the first level of the accumulator stack to a source address offset by the value in the accumulator

Pop (POP)
Moves the value from the first level of the accumulator stack to the accumulator and shifts each value in the stack up one level.

Logical Instructions (Accumulator)

And (AND)
Logically ands the lower 16 bits in the accumulator with a V memory location.

And Double (ANDD)
Logically ands the value in the accumulator with an 8-digit constant or a value in two consecutive V-memory locations.

And Formatted (ANDF)
D2-250-1, D2-260 only. Logically ands the value in the accumulator and a specified range of discrete memory bits (1-32)

And with stack (ANDS)
D2-260 only. Logically ands the value in the accumulator with the first value in the accumulator stack

Or (OR)
Logically ors the lower 16 bits in the accumulator with a V memory location.

Or Double (ORD)
Logically ors the value in the accumulator with an 8-digit constant or a value in two consecutive V-memory locations.

Or Formatted (ORF)
D2-250-1, D2-260 only. Logically ors the value in the accumulator with a range of discrete bits (1-32)

Or with Stack (ORS)
D2-260 only. Logically ors the value in the accumulator with the first value in the accumulator stack

Exclusive Or (XOR)
Performs an Exclusive Or of the value in the lower 16 bits of the accumulator and a V-memory location.

Exclusive Or Double (XORD)
Performs an Exclusive Or of the value in the accumulator and an 8-digit constant or a value in two consecutive V-memory locations.

Exclusive Or Formatted (XORF)
D2-250-1, D2-260 only. Performs an exclusive or of the value in the accumulator and a range of discrete bits (1-32)

Exclusive Or with Stack (XORS)
D2-260 only. Performs an exclusive or of the value in the accumulator and the first accumulator stack location

Compare (CMP)
Compares the value in the lower 16 bits of the accumulator with a V memory location.

Compare Double (CMPD)
Compares the value in the accumulator with two consecutive V memory locations or an 8-digit constant.

Compare Formatted (CMPF)
D2-250-1, D2-260 only. Compares the value in the accumulator with a specified number of discrete locations (1-32)

Compare with Stack (CMPS)
D2-260 only. Compares the value in the accumulator with the first accumulator stack location

Compare Real Number (CMPR)
D2-250-1, D2-260 only. Compares the real number in the accumulator with two consecutive V-memory locations or a real number constant.

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DL205 Instruction Set

Math Instructions (Accumulator)

Add (ADD)
Adds a BCD value in the lower 16 bits in the accumulator with a V memory location. The result resides in the accumulator.

Add Double (ADDD)
Adds a BCD value in the accumulator with two consecutive V memory locations or an 8-digit constant. The result resides in the accumulator.

Add Real Number (ADDR)
D2-250-1, D2-260 only. Adds a real number in the accumulator with a real number constant or a real number contained in two consecutive V-memory locations. The result resides in the accumulator.

Subtract (SUB)
Subtract a BCD value, which is either a V memory location or a 4-digit constant from the lower 16 bits in the accumulator. The result resides in the accumulator.

Subtract Double (SUBD)
Subtracts a BCD value, which is either two consecutive V memory locations or an 8-bit constant, from a value in the accumulator. The result resides in the accumulator.

Subtract Real Number (SUBR)
D2-250-1, D2-260 only. Subtracts a real number, which is either two consecutive V-memory locations or an 8-digit constant, from the real number in the accumulator. The result resides in the accumulator.

Multiply (MUL)
Multiplies a BCD value, which is either a V memory location or a 4-digit constant, by the value in the lower 16 bits in the accumulator. The result resides in the accumulator.

Multiply Double (MULD)
D2-250-1, D2-260 only. Multiplies a BCD value contained in two consecutive V memory locations by the value in the accumulator. The result resides in the accumulator.

Multiply Real Number (MULR)
D2-250-1, D2-260 only. Multiplies a real number, which is either two consecutive V-memory locations or a real number constant, by the real number in the accumulator. The result resides in the accumulator.

Divide (DIV)
Divides a BCD value in the accumulator by a BCD value which is either a V memory location or a 4-digit constant. The result resides in the accumulator.

Divide Double (DIVD)
D2-250-1, D2-260 only. Divides a BCD value in the accumulator by a BCD value which is either two consecutive V memory locations or a 8-digit constant. The result resides in the accumulator.

Divides Real Number (DIVR)
D2-250-1, D2-260 only. Divides a real number in the accumulator by a real number which is either two consecutive V-memory locations or a real number constant. The result resides in the accumulator.

Increment (INC)
D2-250-1, D2-260 only. Increments a BCD value in a specified V memory location by 1 each time the instruction is executed.

Decrement (DEC)
D2-250-1, D2-260 only. Decrements a BCD value in a specified V memory location by 1 each time the instruction is executed.

Add Binary (ADDB)
D2-250-1, D2-260 only. Adds the binary value in the lower 16 bits of the accumulator to a value which is either a V memory location or a 16-bit constant. The result resides in the accumulator.

Add Binary Double (ADDBD)
D2-260 only. Adds the binary value in the accumulator to a value which is either two consecutive V-memory locations or a 32-bit constant. The result resides in the accumulator

Subtract Binary (SUBB)
D2-250-1, D2-260 only. Subtract a 16-bit binary value, which is either a V memory location or a 16-bit constant, from the lower 16 bits in the accumulator. The result resides in the accumulator.

Subtract Binary Double (SUBBD)
D2-260 only. Subtracts a 32-bit binary value, which is either two consecutive V-memory locations or a 32-bit constant, from the value in the accumulator. The result resides in the accumulator

Multiply Binary (MULB)
D2-250-1, D2-260 only. Multiples a 16-bit binary value, which is either a V memory location or a 16-bit constant, by the lower 16 bits in the accumulator. The result resides in the accumulator.

Divide Binary (DIVB)
D2-250-1, D2-260 only. Divides the binary value in the lower 16 bits in the accumulator by a value which is either a V memory location or a 16-bit constant. The result resides in the accumulator.

Increment Binary (INCB)
Increments a binary value in a specified V memory location by 1 each time the instruction is executed.

Decrement Binary (DECB)
Decrements a binary value in a specified V memory location by 1 each time the instruction is executed.

Add Formatted (ADDF)
D2-260 only. Adds the BCD value in the accumulator to a value which is a range of discrete bits (1-32). The result resides in the accumulator

Subtract Formatted (SUBF)
D2-260 only. Subtracts a BCD value which is a range of discrete bits (1-32) from the BCD value in the accumulator. The result resides in the accumulator

Multiply Formatted (MULF)
D2-260 only. Multiplies a BCD value in the lower 16-bits in the accumulator by a BCD value which is a range of discrete bits (1-16). The result resides in the accumulator

Divide Formatted (DIVF)
D2-260 only. Divides the BCD value in the lower 16-bits in the accumulator by the BCD value which is a range of discrete bits (1-16). The result resides in the accumulator

Add Top of Stack (ADDS)
D2-260 only. Adds the BCD value in the accumulator with the BCD value in the first level of the accumulator stack. The result resides in the accumulator

Subtract Top of Stack (SUBS)
D2-260 only. Subtracts the BCD value in the first level of the accumulator stack from the BCD value in the accumulator. The result resides in the accumulator

Multiply Top of Stack (MULS)
D2-260 only. Multiplies a 4-digit BCD value in the first level of the accumulator stack by a 4-digit BCD value in the accumulator. The result resides in the accumulator

Divide by Top of Stack (DIVS)
D2-260 only. Divides the 8-digit BCD value in the accumulator by the 4-digit BCD value in the first level of the accumulator by the 4-digit BCD value in the first level of the accumulator stack. The result resides in the accumulator

Add Binary Top of Stack (ADDBS)
D2-260 only. Adds the binary value in the accumulator with the binary value in the first accumulator stack location. The result resides in the accumulator

Subtract Binary Top of Stack (SUBBS)
D2-260 only. Subtracts the binary value in the first level of the accumulator stack from the binary value in the accumulator. The result resides in the accumulator

Multiply Binary Top of Stack (MULBS)
D2-260 only. Multiplies the 16-bit binary value in the first level of the accumulator stack by the 16-bit binary value in the accumulator. The result resides in the accumulator

Divide Binary Top of Stack (DIVBS)
D2-260 only. Divides a value in the accumulator by the binary value in the top location of the stack. The accumulator contains the result

Transcendental Instructions (D2-260 only)

Square Root Real (SQRTR)
Takes the square root of the real number stored in the accumulator. The result resides in the accumulator.

Sine Real (SINR)
Takes the sine of the real number stored in the accumulator. The result resides in the accumulator.

Cosine Real (COSR)
Takes the cosine of the real number stored in the accumulator. The result resides in the accumulator.

Tangent Real (TANR)
Takes the tangent of the real number stored in the accumulator. The result resides in the accumulator.

ARC Sine Real (ASINR)
Takes the inverse sine of the real number stored in the accumulator. The result resides in the accumulator.

ARC Cosine Real (ACOSR)
Takes the inverse cosine of the real number stored in the accumulator. The result resides in the accumulator.

ARC Tangent Real (ATANR)
Takes the inverse tangent of the real number stored in the accumulator. The result resides in the accumulator.

Bit Instructions (Accumulator)

Sum (SUM)
D2-250-1, D2-260 only. Counts the number of bits set to "1" in the accumulator. The HEX result resides in the accumulator..

Shift Left (SHFL)
Shifts the bits in the accumulator a specified number of places to the left.

Shift Right (SHFR)
Shifts the bits in the accumulator a specified number of places to the right.

Rotate Left (ROTL)
D2-250-1, D2-260 only. Rotates the bits in the accumulator a specified number of places to the left.

Rotate Right (ROTR)
D2-250-1, D2-260 only. Rotates the bits in the accumulator a specified number of places to the right.

Encode (ENCO)
Encodes the bit position set to 1 in the accumulator, and returns the appropriate binary representation in the accumulator.

Decodes (DECO)
Decodes a 5 bit binary value (0-31) in the accumulator by setting the

Number Conversion Instructions (Accumulator)

Binary (BIN)
Converts the BCD value in the accumulator to the equivalent binary value. The result resides in the accumulator.

Binary Coded Decimal (BCD)
Converts the binary value in the accumulator to the equivalent BCD value. The result resides in the accumulator.

Invert (INV)
Takes the one's complement of the 32-bit value in the accumulator. The result resides in the accumulator.

Ten's Complement (BCDCPL)
Takes the 10's complement (BCD) of the 8-digit accumulator.

ASCII to HEX (ATH)
D2-250-1, D2-260 only. Converts a table of ASCII values to a table of hexadecimal values.

HEX to ASCII (HTA)
D2-250-1, D2-260 only. Converts a table of hexadecimal values to a table of ASCII values.

Segment (SEG)
D2-250-1, D2-260 only. Converts four digit HEX value in accumulator to seven segment display format.

Gray Code to BCD (GRAY)
D2-240, D2-250-1, D2-260 only. Converts a 16-bit GRAY code value in the accumulator to a corresponding BCD value. The result resides in the accumulator.

Shuffle Digits (SFLDGT)
D2-240, D2-250-1, D2-260 only. Shuffles a maximum of 8 digits, rearranging them in a specified order. The result resides in the accumulator.

Radian Real Conversion (RADR)
D2-260 only. Converts the real degree value in the accumulator to the equivalent real number in radians. The result resides in the accumulator

Degree Real Conversion (DEGR)
D2-260 only. Converts the real radian value in the accumulator to the equivalent real member of degrees. The result resides in the accumulator

Binary to Real Number (BTOR)
D2-250-1, D2-260 only. Converts the binary value in the accumulator into a real number. The result resides in the accumulator.

Real to Binary (RTOB)
D2-250-1, D2-260 only. Converts the real number in the accumulator into a binary value. The result resides in the accumulator.

Table Instructions

Move (MOV)
Moves the values from one V memory table to another V memory table.

Move Memory Cartridge/Load Label (MOVMC/LDLBL)
D2-240, D2-250-1, D2-260 only. Copies data between V memory and program ladder memory.

Set Bit (SETBIT)
D2-260 only. Sets a single bit (to a 0) in a V-memory location.

Reset Bit (RSTBIT)
D2-260 only. Resets a single bit (to a 0) in a V-memory location.

Extended Table Instructions (D2-260 only)

Fill (FILL)
Fills a table of specified V-memory locations with a value which is either a V-memory location or a 4-digit constant.

Find (FIND)
Finds a value in a V-memory table and returns the table position containing the value to the accumulator.

Find Greater Than (FDGT)
Finds a value in a V-memory table which is greater than the specified search value. The table position containing the value is returned to the accumulator.

Find Block (FINDB)
Finds a block of data values in a V-memory table and returns the starting address of the table containing the values to the accumulator.

Table to Destination (TTD)
Moves the value form the top of a V-memory table to a specified V-memory location. The table pointer increments each scan.

Remove from Bottom (RFB)
Moves the value from the bottom of a v-memory table to a specified V-memory location. The table pointer increments each scan.

Source To Table (STT)
Moves a value from a specified V-memory location to a V-memory table. The table pointer increments each scan.

Remove from Top (RFT)
Pops a value from the top of a V-memory table and stores it in a specified V-memory location. All other values in the V-memory table are shifted up each time a value is popped from the table.

Add To Top of Table (ATT)
Pushes a value from a specified V-memory location onto the top of a V-memory table. All other values in the V-memory table are shifted down each time a value is pushed onto the table.

Table Shift Left (TSHFL)
Shifts s specified number of bits to the left in a V-memory table.

Table Shift Right (TSHFR)
Shifts a specified number of bits to the right in a V-memory table.

And Move (ANDMOV)
Copies data from a table to the specified location, ANDing each word with the accumulator data as it is written.

Or Move (ORMOV)
Copies data from a table to the specified memory location, ORing each word with the accumulator data as it is written.

Exclusive Or Move (XORMOV)
Copies data from a table to the specified memory location, XORing each word with the accumulator data as it is written.

Swap (SWAP)
Exchanges the data in two tables of equal length.

Clock / Calender Instructions

Date (DATE)
D2-250-1, D2-260 only. Use to set the date in the CPU.

Time (TIME)
D2-250-1, D2-260 only. Use to set the time in the CPU.

CPU Control Instructions

No Operation (NOP)
Inserts a no operation coil at specified program address.

End (END)
Marks the termination point for the normal program scan. An End instruction is required at the end of the main program body.

Stop (STOP)
Changes the operational mode of the CPU from Run to Program (Stop)

Reset Watchdog Timer (RSTWT)
D2-240, D2-250-1, D2-260 only. Resets the CPU watchdog timer.

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DL205 Instruction Set

Program Control Instructions

Goto Label (GOTO) (LBL)
D2-240, D2-250-1, D2-260 only. Skips all instructions between the Goto and corresponding LBL instructions.

For/Next (FOR/NEXT)
D2-240, D2-250-1, D2-260 only. Executes the logic between the FOR and NEXT instructions a specified number of times.

Goto Subroutine (GTS/SBR/RT/RTC)
GTS, SBR, RT: D2-240, D2-250-1, D2-260 only.
RTC: D2-250-1, D2-260 only.
When a GTS instruction is executed the program jumps to the SBR (Subroutine). The subroutine is terminated with a RT instruction (unconditional return). When a return is executed, the program continues from the instruction after the calling GTS instruction. The RTC (Subroutine return conditional) instruction is used with an input contact to implement a conditional return from the subroutine.

Master Line Set/Master Line Reset (MLS/MLR)
Allows the program to control sections of ladder logic by forming a new power rail. The MLS marks the beginning of a power rail and the MLR marks the end of the power rail control.

Interrupt Instructions

Interrupt Routine/Interrupt Return/Interrupt Return Conditional (INT/IRT/IRTC)
INT, IRT: D2-240, D2-250-1, D2-260 only.
IRTC: D2-250-1, D2-260 only.
When a hardware or software interrupt occurs, the interrupt routine will be executed. The INT instruction is the beginning of the interrupt routine. The interrupt routine is terminated with an IRT of the interrupt routine. The in interrupt routine is terminated with an IRT instruction (unconditional interrupt return). When a interrupt return is reached the execution of the program continues from the instruction where the program execution was prior to the interrupt.

Enable Interrupt (ENI)
D2-240, D2-250-1, D2-260 only. Enables hardware and software interrupts to be acknowledged.

Disable Interrupt (DISI)
D2-240, D2-250-1, D2-260 only. Disables hardware and software interrupts from being acknowledged.

Intelligent I/O Instructions

Read from Intelligent Module (RD)
Reads a block of data from an intelligent I/O module into CPU's V memory.

Write to Intelligent Module (WT)
Writes a block of data to an intelligent I/O module from a block of CPU's V memory.

Message Instructions

Fault/Data Label (FAULT/DLBL)
FAULT: D2-240, D2-250-1, D2-260 only.
DLBL: All D2 CPUs.
Displays a V memory value or a data label constant to the hand-held programmer or personal computer using DirectSOFT.

Numerical Constant/ASCII constant (NCON/ACON)
Stores constants in numerical or ASCII form for use with other instructions.

Print Message (PRINT)
D2-250-1, D2-260 only.
Prints the embedded text or text/data variable message to the specified communications port. Maximum message length is 255 words. appropriate bit position to 1 in the accumulator.

Network Instructions

Read from network (RX)
D2-240, D2-250-1, D2-260 only. Reads a block of data from another CPU on the network.

Write to network (WX)
D2-240, D2-250-1, D2-260 only. Writes a block of data from the master device to a slave device on the network.

MODBUS Instructions (D2-260 only)

MODBUS Read (MRS)
Used CPU port 2 to read a block of data from MODBUS RTU devices on the network.

MODBUS Write (MWX)
Writes a block of data from CPU port 2 to MODBUS RTU devices on the network.

ASCII Instructions (D2-260 only)

ASCII IN (AIN)
Configures port 2 to read raw ASCII input strings.

ASCII Find (AFIND)
Searches ASCII strings in V-memory to find a specific portion of the string.

ASCII IN (AEX)
Extracts a specific portion from an ASCII string.

Compare V-memory (CMPV)
Compares two blocks of V-memory.

Swap Bytes (SWAPB)
Swaps V-memory bytes.

Print to V-memory (VPRINT)
Used to send pre-coded ASCII strings to a pre-defined V-memory address when enabled.

Print from V-memory (PRINTV)
Used to write raw ASCII string out of port 2 when enabled.

Drum Instructions (D2-250-1, D2-260 only)

Tuned Drum with Discrete Outputs (DRUM)
Time driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts to trigger the transition to the next step. Also define preset step as destination when reset occurs.

Time & Event Drum with Discrete Outputs (EDRUM)
Time and/or event driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

Time and Event Drum with Discrete Outputs and Output Mask (MDRMD)
Time and/or event driven drum with up to 16 steps and 16 discrete output points. Actual output status is the result of a bit-by-bit AND between the output mask and bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define present step as destination when reset occurs.

Time and Event Drum with Word Output and Output Mask (MDRMW)
Time and/or event driven drum with up to 16 steps and a single V-memory output location. Actual output word is the result of a bit-by-bit AND between the word mask and the bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

RLL^{PLUS} Programming Instructions

(D2-240, D2-250-1, D2-260 only)

Initial stage (ISG)
The initial stage instruction is used for a starting point for user application program. The ISG instruction will be active on power up and PROGRAM to RUN transitions.

Stage (SG)
Stage instructions are used to create structured programs. They are program segments which can be activated or deactivated with control logic.

Jump (JMP)
Normally open coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.

Not Jump (NJMP)
Normally closed coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.

Converge Stages (CV)
Converge stages are a group of stages that when all stages are active the associated converge jump(s). (CVJMP)will activate another stage(s). One scan after the CVJMP is executed, the converge stages will be deactivated.

Converge Jump (CVJMP)
Normally open coil that deactivates the active CV stages and activates a specified stage when there is power flow to the coil.

Block Call/Block/Block End (BCALL w/BLK and BEND)
BCALL is a normally open coil that activates a block of stages when there is power flow to the coil. BLK is the label which marks the beginning of a block of stages. Bend is a label used to mark the end of a block of stages

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